ADVANCED ENERGY ECONOMY

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WESTERN RTO ECONOMIC IMPACT STUDY

REGION-WIDE ANALYSIS

Prepared for Advanced Energy Economy
by Energy Strategies, LLC, and Peterson & Associates

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ABOUT ENERGY STRATEGIES, PETERSON & ASSOCIATES, AND THIS REPORT

Energy Strategies and Peterson & Associates were selected to perform a Western RTO Economic Impact Study as part of a Request for Proposals issued by Advanced Energy Economy (AEE) in 2021. This report provides the total, combined economic impacts for the 11 Western states that were evaluated as part of this study effort. It also provides background on the methods and assumptions utilized in performing the analyses. In addition to this report, individual state reports will be made available that provide summaries of each individual state's economic impact results. This study, along with the individual state reports, are intended for policymakers and energy industry professionals. The reports contain some technical information but seek to provide policymakers with a high-level understanding of the concepts, assumptions, approaches, and findings, which are not intended to require specialization in the electricity industry or in economic theory.

This publication was prepared based on the independent work of Energy Strategies and Peterson & Associates, sponsored by AEE. It is provided with no warranties or guarantees, express or implied, relating to this work, and neither Energy Strategies nor Peterson & Associates are liable for any damages of any kind attributable to the use of this report or other study materials.

This work relies on a variety of inputs and assumptions, including results from the "State-Led Market Study." Energy Strategies served as the primary contractor for the State-Led Market Study. However, in assessing, reporting, and incorporating the results of the State-Led Market Study into this analysis, Energy Strategies relied on the publicly available results and information from that study effort.

ABOUT ADVANCED ENERGY ECONOMY

Advanced Energy Economy (AEE) is a national association of businesses that are making the energy we use secure, clean, and affordable. AEE is the only industry association in the U.S. that represents the full range of advanced energy technologies and services, both grid-scale and distributed. Advanced energy includes energy efficiency, demand response, energy storage, wind, solar, hydro, nuclear, electric vehicles, and more. AEE's mission is to transform public policy to enable rapid growth of advanced energy businesses. Engaged at the federal level and more than a dozen states around the country, AEE represents more than 100 companies in the $238 billion U.S. advanced energy industry, which employs 3.2 million U.S. workers. Follow us at @AEEnet.

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1.0 EXECUTIVE SUMMARY

This report quantifies the economic benefits[1] that might accrue to 11 Western states[2] from development of a broad, West-wide organized electricity market known as a Regional Transmission Organization (RTO). Energy Strategies and Peterson & Associates prepared this report at the request of the Advanced Energy Economy (AEE) to fill a research gap on the broader economic impacts that might result from the electricity cost savings and structural changes brought about by a potential RTO in the West. The analysis performed in this *Western RTO Economic Impact Study*, and forthcoming companion state-level economic impact result summaries, find that substantial economic benefits, including new jobs, new indirect business taxes, and increases to Gross Regional Product are likely to flow to the region if a Western RTO is established.

There are a variety of categories of benefits that might be brought about by an RTO (or other organized electricity market structure). This study considers a subset of the energy-related benefits that might occur due to the operation of an RTO in the region, specifically the operational and capacity savings. This analysis then seeks to understand how those electricity cost savings flow into the economy and create broader, non-energy related economic impacts.

This study focused on evaluating two broad categories of economic impacts that may result from an RTO:

1. The economic impacts to Western states from **increased spending power for households** that would occur due to electricity prices being lower under an RTO than they would be under a continuation of the status quo in Western electricity markets, and

2. The economic impacts from **new or expanded business activity** that may occur due to RTO development, including both:

    a. The impact of lower electricity prices for businesses, incentivizing them to expand in or locate to Western states, and

[1] This report, technically, measures economic contributions/impacts. But the term "benefits" is used to simplify and provide better context for the reader.

[2] The states evaluated in this study are: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. While portions of some of these states are not wholly within the Western Interconnection, the economic impacts reported herein are the impacts expected across the state as a whole.

b. Structural changes to the electricity market enabling new renewable energy development contracts to meet corporate clean energy demand, which is currently taking place primarily in regions with RTOs.

This analysis presents a range of potential economic impacts to the West which vary based on how sensitive firms ultimately are to electricity prices and on how much additional clean electricity generating capacity is built across the region. While the range of impacts is fairly broad, the results demonstrate that, even on the low-end, the economic benefits of an RTO to Western states are expected to be substantial.

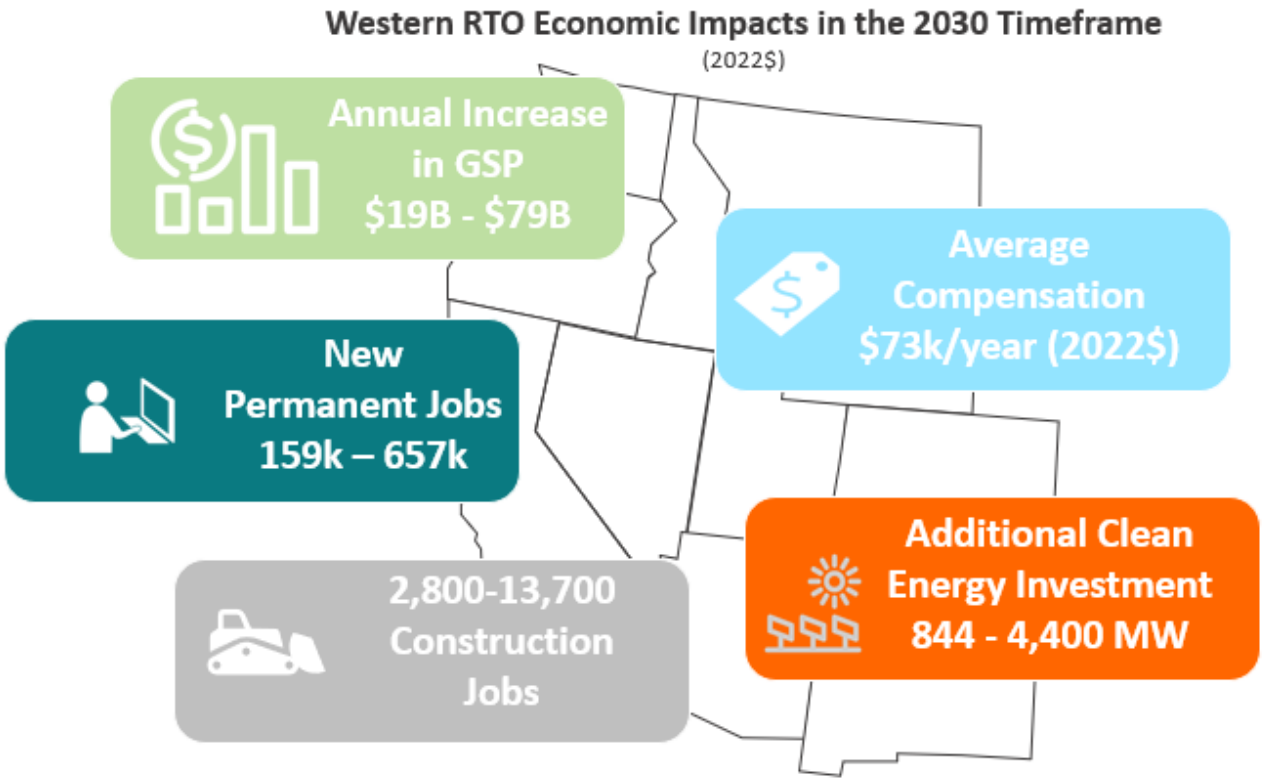
The range of economic impacts to the 11-state region in the 2030 timeframe is illustrated below in Figure 1-1. In summary, the creation of a West-wide RTO is expected to:

- Provide between **159,000 and 657,000 permanent jobs** across the region, with those jobs averaging total compensation (payroll plus benefits) of roughly $73,000 per year.
- Generate between **$18.8 billion and $79.2 billion in additional Gross Regional Product per year** across the 11-state region (equivalent to 0.4% to 1.6% of the region's current, Gross Regional Product)[3]
- Produce incremental tax contributions ranging between **$619 million and $2.4 billion per year**
- Create **2,800 to 13,700 temporary construction jobs** in 2030 from the development of additional clean energy resources to meet corporate demand resulting in an **additional $266 million to $1.3 billion in Gross Regional Product** and **$16 to $50 million in taxes** on a temporary basis.

The analysis finds that the Western region, and every individual Western state, could expect economic benefits from a West-wide RTO. Benefits to the economy would be driven by lower electricity prices (in comparison to a case without an RTO) for households and businesses, additional clean energy development across the region, and expansion of existing or attraction of new businesses to the West. The sooner RTO development occurs, the sooner the region can be put on the path to realizing these long-run benefits.

[3] Current Gross Regional Product and Earnings data were sourced from the Emsi-BG databases.

Figure 1-1 Summary of Range Non-Energy Economic Impacts Associated with RTO Formation



2.0 INTRODUCTION

This analysis focused on the estimated economic impacts to the 11 states that make up the Western Interconnection[4] from the creation and operation of a West-wide Regional Transmission Organization (RTO). This report summarizes the combined economic benefits to the West, as a whole, as well as provides background on the methodology and assumptions utilized in conducting this analysis. Additional companion summaries for each of the 11 states are expected to be posted in the future to provide more in-depth information on specific impacts to individual states.[5]

This study focused on how the benefits of an organized electricity market, known as an RTO, might provide broader economic benefits to the West as a whole, including increases to Gross Regional State Product (GRP), the creation of new jobs, and state-level tax receipts. These benefits stem from the electricity cost savings brought about by an RTO, which then flow into the broader economy, providing benefits to electricity ratepayers, including households and businesses. Several recent reports have assessed the direct electricity cost savings and other energy-related benefits from organized electricity market constructs, including RTOs.[6] This current study aims to fill a heretofore existing information gap on how the benefits an RTO brings to the electricity system might drive follow-on benefits in other sectors, representing economic impacts in the broader economy. The assessment in this report focused on benefits to the economy driven by: (1) electricity cost savings creating increased spending power for households, and (2) new business activity in the region including both additional clean energy development and expansion of existing or attraction of new businesses to the West due to lower electricity prices.

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[4] The 11 primary states in the Western Interconnection, which are included in this report's definition of "Western states" are: Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Oregon, Utah, Washington, and Wyoming.

[5] Summaries outlining state-level results are expected to be posted at https://www.aee.net/aee-reports when available.

[6] These studies include:

- *State-Led Market Study*; prepared by Energy Strategies; July 31, 2021; available here: https://www.energystrat.com/new-insights-experience
- *EDAM Feasibility Assessment;* prepared by Brattle and E3, summary available here: http://www.caiso.com/InitiativeDocuments/Presentation-ExtendedDay-AheadMarketFeasibilityAssessmentUpdate-EIMEntities-Oct3-2019.pdf
- *Colorado Transmission Coordination Act: Evaluation of Market Alternatives;* prepared by Siemens PTI; June, 2021, available here: https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=948065&p_session_id=

This report analyzed the expected economic benefits of an RTO in three representative years (2025, 2030, and 2035). These years were selected to help demonstrate the sustained nature of the economic impacts of an RTO and the relative direction that economic impacts are expected to move over time. However, it is important to note that the study has not made a specific assumption about the date an RTO would, or could, become operational in the region. And the economic benefits reported herein, for each of the representative years, are those expected to accrue to the states once an RTO is operational and mature enough to make an impact on business decisions.[7] Readers should be aware that achieving the level of benefits reported in this study will take time to accrue following the creation of an RTO. In interpreting the study's results, readers should understand that each individual year may or may not represent what is actually achievable in that timeframe, depending on the status of market development at that time.

The remainder of this section provides background on organized wholesale markets (RTOs), provides a high-level review of prior study work that was leveraged in this analysis, summarizes the goals of this study, and provides a brief overview of the organization of the remainder of the report.

All results are reported in 2022 dollars.[8]

2.1 Overview of Regional Transmission Organizations

RTOs (and, similarly, Independent System Operators, or "ISOs")[9] are independent, non-profit organizations tasked with ensuring electricity system reliability and economically optimizing supply and demand for wholesale electric power within their geographic area. These organizations control, coordinate, and monitor the electric transmission system in their jurisdictions as independent authorities which are regulated by the Federal Energy Regulatory Commission (FERC).[10]

[7] The authors recognize that it will take time from the date of RTO formation (whenever that may occur) until the time when businesses may expand or be attracted to the region as a result of lower electricity prices and when new clean electricity resources may be developed in the region under new contracting mechanisms made available by the RTO. While this reality is recognized, the analysis did not specifically focus on how that ramp up would occur and how long it would take individual industries to react to the changes brought about by RTO formation. Thus, the results for individual years are representative of long-run forecasted outcomes and not highly specific point-estimates for that individual year.

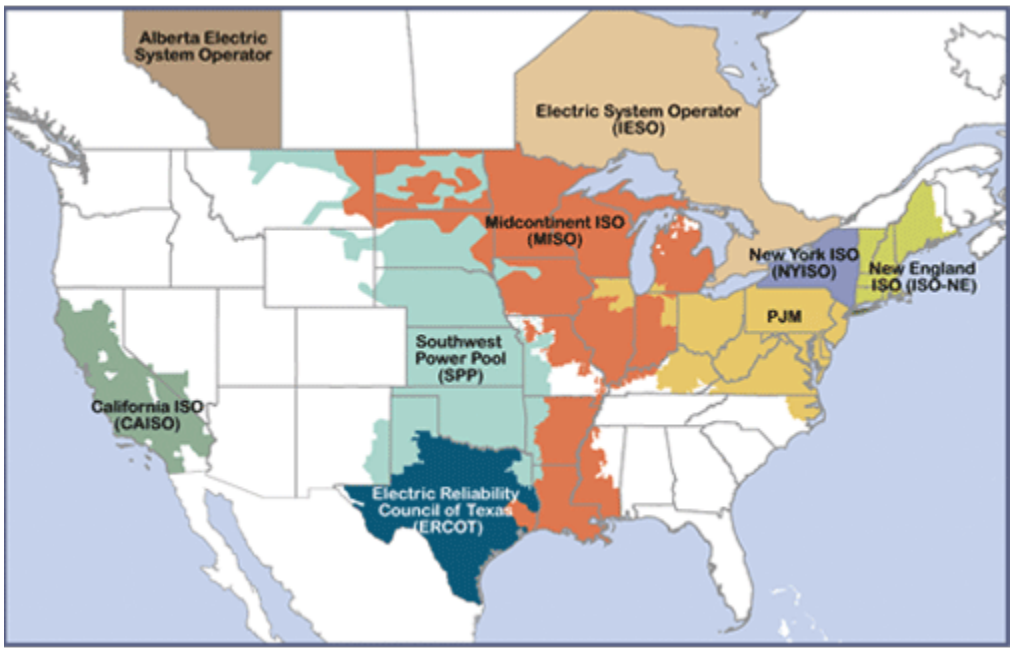
[8] Note that the research and analysis for this study began in 2021 and relied on projected inflation rates developed in 2020, which turned out to be conservative for the 2021/2022 timeframe. See Consumer Price Index data reported here: https://www.ssa.gov/oact/tr/2020/lr5b1.html for inflation data used to convert to 2022 dollars in this report.

[9] For purposes of this reports, the term RTO will be used interchangeably with the term ISO.

[10] Except in the case of ERCOT in Texas.

RTO formation in the United States started during electricity restructuring in the 1990s. Now these organizations cover much of the geographic footprint of the United States, with notable exceptions in the northwest, southwest, and southeast. The California Independent System Operator (CAISO) operates the sole RTO in the U.S. portion of the Western Interconnection, as seen in Figure 2-1.

Figure 2-1 – RTOs and ISOs[11]



RTOs perform a variety of tasks including managing transmission and energy flows across the market footprint, performing transmission planning, ensuring reliable operation of the electric grid, ensuring nondiscriminatory access to transmission service, and overseeing wholesale energy market transactions and cash flows within the market. By increased coordination and the sharing of resources available within the RTO footprint in a more organized and optimized manner, these organizations can improve reliability while lowering costs through competition and innovation across a larger geographic area. These RTO features can also increase access to, and utilization of, clean energy resources. Numerous studies have examined and quantified the benefits associated with different organized electricity market structures (including RTOs).[12] The list below summarizes several high-level categories of benefits offered by an RTO, many of which will help reduce electricity prices.

- Operational Efficiencies – RTOs offer operational efficiencies from more efficient use of existing generation and transmission. RTOs use market-based mechanisms to optimize dispatch of

[11] Source: https://www.ferc.gov/power-sales-and-markets/rtos-and-isos
[12] See footnote #6 for examples of these recent studies.

electricity generation resources to meet demand, resulting in lower costs by infusing competition into the energy market and maximizing use of the transmission system.

- Lower Peak Capacity Needs – RTOs allow the loads within their footprint to, effectively, aggregate their demands together. Due to geographical diversity, this aggregation often results in a lower coincident peak electricity demand requirement across the RTO footprint than would exist if those same demands had to be individually met by utilities or Balancing Authorities.[13] This, in turn, reduces the amount of generation capacity required to meet a given level electricity demand and, therefore, reduces the need to build additional generation capacity, resulting in savings in the region from avoided spending, leaving those savings available for other uses.

- Renewables Integration – RTOs allow renewable energy to be more efficiently developed, better integrated, and reach more customers than if individual Balancing Authority Areas (or utility footprints) were to integrate such renewables on their own. The market's optimization of generation and transmission resources can increase the ability to use renewable generation at its full capability (in other words, the market can help prevent curtailment of the output of renewable resources). These benefits can also help reduce overall electricity prices within the RTO footprint.

- Transmission Planning – Under an RTO construct, most larger transmission facilities within the footprint are jointly planned by the RTO, which considers transmission solutions across the footprint. The consideration of a broader geography and the use of a unified planning approach may provide for more cost-effective solutions for transmission projects to achieve reliability, economic and public policy needs.

- Enhanced Reliability – RTOs have a wide area view of what is happening on the electrical grid within their entire footprint and have access to information on generator availability and transmission limitations. This allows the RTO to coordinate resources across the broad region to minimize grid disruption from natural disasters, severe weather, or grid emergencies. While RTOs can enhance reliability within their footprints, reliability issues may still exist in RTOs and appropriate, long-term resource planning is imperative to ensuring reliability can be achieved. Nonetheless, all else equal, RTOs should have additional information, visibility, and tools available

[13] According to the North American Electricity Reliability Corporation (NERC), a Balancing Authority is the responsible entity that integrates resource plans ahead of time, maintains demand and resource balance within a Balancing Authority Area, and supports interconnection frequency in real time. https://www.nerc.com/files/glossary_of_terms.pdf

to them to address shortage conditions compared to other market constructs, which are less organized and coordinated.

This study focuses on the electricity cost savings and follow-on economic benefits that can be achieved through the first two categories of energy-related benefits: operational efficiencies and lower peak capacity needs. Other categories of benefits may offer further electricity cost savings compared to operation of the grid without an RTO, but those benefits can be more difficult to quantify and are subject to more uncertainty. For instance, the benefit of increased reliability offered by RTOs is difficult to quantify and is not specifically considered in this analysis, though it may be substantial, as the economic cost of electricity system interruptions can be extremely high.[14] Thus, the benefits of RTOs analyzed in this study should be viewed conservative in nature, as the study only assesses likely economic impacts from electricity benefits offered by a subset of known RTO benefit categories.

2.2 Current Status of Market Development in the West

In the Western United States, only a portion of the system is managed by an RTO (the CAISO), with the remaining portion of the Western Interconnection currently managed by nearly 40 separate and independent Balancing Authorities, each responsible for ensuring a balance of supply and demand, and for maintaining reliability within their own footprint. Despite numerous discussions on wholesale electricity market formation over the last two-plus decades, the utilities in the Western Interconnection have not integrated into a West-wide RTO. Nevertheless, in recent years, organized market options in the West have expanded. There has been an emergence of real-time only organized market solutions, including the Western Energy Imbalance Market (WEIM) offered by CAISO and Western Energy Imbalance Service (WEIS) offered by the Southwest Power Pool (SPP). By offering a low-cost, voluntary, real-time market option, the CAISO and SPP have leveraged their existing market optimization tools (used for their existing RTO footprints) to extend provision of a limited number of services to utilities within the West that do not fully participate in their RTO. These real-time market services, generally consisting of intra-hour optimization of electricity generation, have demonstrated the scale of benefits that organized market frameworks could achieve in the West. For instance, the WEIM has generated more than $2 billion in savings to a host of utilities across the West[15] by providing just a subset of the services provided by an RTO.

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[14] For instance, the Midcontinent Independent System Operator's Tariff Schedule 28 establishes the Value of Lost Load at $3,500/MWh (or $3.50/kWh). To the extent an RTO can prevent loss of load within its footprint, it may offer substantial economic benefits from avoiding the economic cost of outages.

[15] *WEIM Benefits Report First Quarter 2022*, prepared by CAISO, available at: https://www.westerneim.com/Documents/ISO-Western-Energy-Imbalance-Market-Benefits-Report-Q1-2022.pdf

Recognizing the benefits that more comprehensive regional coordination can deliver, several efforts to expand market participation, and the set of services provided by the market, have commenced in the West. These activities include CAISO's Extended Day-Ahead Market Initiative (EDAM), Western Power Pool's Western Resource Adequacy Program (WRAP), and SPP's Markets+ initiative. Additionally, a small set of utilities in the West are in the process of establishing the terms and conditions under which they would join the SPP RTO, which would extend the SPP RTO footprint into the Western Interconnection.[16]

Not only are Western utilities and potential market operators evaluating market participation options, up to and including full RTO participation, recently Nevada and Colorado passed laws which require certain utilities within those states to join an organized market by 2030, unless their public utility commissions find that joining such a market is ***not*** in the public interest.[17]

Thus, there are several efforts already underway in the West to evaluate and expand the role of organized wholesale markets, up to and including RTOs. This study looks at the potential economic impacts to the West should those efforts ultimately culminate with implementation of a full RTO which spans the entirety of the Western Interconnection.[18]

2.3 State-Led Market Study

As stakeholders in the West have evaluated potential expansion of organized wholesale markets, a number of studies have been completed to estimate the potential electricity cost savings, and other benefits, that could be achieved through the expansion of market services, up to and including RTO formation.[19] These studies tend to focus on the electricity cost savings associated with new or expanded markets relative to a baseline (or status quo) case where new or expanded markets do not come to fruition. One such study, the *State-Led Market Study*,[20] provides a useful baseline and starting point for this analysis. This *Western RTO Economic Impact Study* relies substantially on the

[16] Today, SPP operates an RTO in the Eastern Interconnection, but under the proposal being considered, that RTO footprint would expand into certain areas of the Western Interconnection and optimization would occur across the DC ties that connect the two interconnections.
[17] See: https://www.leg.state.nv.us/App/NELIS/REL/81st2021/Bill/8201/Text and https://leg.colorado.gov/bills/sb21-072
[18] Note that, for purposes of the *State-Led Market Study's* "One Market" footprints, Alberta was assumed to remain in its own market, while BC Hydro was generally included as part of the larger market footprint.
[19] See footnote #6 for examples of recent studies.
[20] The "*State-Led Market Study*" (*Exploring Western Organized Market Configurations: A Western State's Study of Coordinated Market Options to Advance State Energy Polices*) dated July 30, 2021 includes two companion reports: Technical Report, Market and Regulatory Review.

quantification of electricity system benefits from the Technical Report portion of the *State-Led Market Study*.

The *State Led Market Study* included a detailed evaluation of the electricity system cost savings associated with various wholesale market constructs in the Western Interconnection. It was prepared for 11 participating states and was funded through a U.S. Department of Energy State Energy Program Competitive Grant awarded to the state energy offices in Utah, Idaho, Colorado, and Montana. While the study's grantees were only a subset of Western states, all 11 Western states included in this analysis participated in the study's "Lead Team" which guided and advised on the study's design, approach, and findings.[21] The Lead Team's objective for the study was to provide Western states with a neutral forum and neutral analysis of the options and impacts associated with new or more centralized wholesale energy markets in the West.

To support that objective, the *State-Led Market Study*'s Technical Report quantified the electricity system benefits of real-time, day-ahead, and RTO markets across a series of potential market footprints in the West. Expanded market services and footprints were compared to a "status quo" future, where existing and announced real-time energy markets (such as the WEIM and WEIS) were assumed to continue to operate. By comparing a status quo future to different potential market expansion futures, the *State-Led Market Study* was able to estimate the ***incremental*** benefits of new or expanded market offerings. Specifically of interest for this work, the *State-Led Market Study* quantified the anticipated electricity cost savings associated with the formation and operation of a West-wide RTO. The *State-Led Market Study's* calculated benefits of a large, West-wide RTO are a critical input into this study's analysis of the broader economic impacts of RTO operation, as they provide the starting point for evaluating broader economic impacts across the West.

The *State-Led Market Study* assessed a subset of potential electricity-system benefits that can be offered by RTOs (and other market types) and "took a conservative approach to benefit inclusion and quantification."[22] It quantified two primary types of benefits: operational savings and capacity savings. These broad savings categories were briefly described in Section 2.1 and additional details on the methods for quantifying each category of benefits are described in more detail in the *State-Led Market Study: Technical Report*.[23] In the context of the *State-Led Market Study*, the generation resource mix

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[21] Note that Energy Strategies served as the Lead Contractor for the *State-Led Market Study* effort and, as such, is highly familiar with the study's approach, findings, and results. In preparing this study, the publicly available information and results from the *State-Led Market Study* were utilized and no new power system modeling was undertaken.

[22] *State-Led Market Study: Technical Report*; July 31, 2021; page 24; available here: https://www.energystrat.com/s/Final-Roadmap-Technical-Report-210730.pdf

[23] Generally, operational savings were quantified using a production cost model that was used to simulate market operations. Capacity savings were quantified by evaluating anticipated coincident and non-coincident

was held constant across all market configurations analyzed. Therefore, the benefits from that study, and consequently most of the economic impacts in this current study,[24] are attributable solely to the market services offered by an RTO and not to potential changes in the electricity generation resource mix.

While a variety of market constructs were studied in the *State-Led Market Study*, the One-Market RTO configuration, which assumed all western Balancing Authorities were consolidated into a single West-wide RTO footprint, generated the maximum level of West-wide benefits when compared to the other market configurations analyzed. In addition to quantifying the benefits of a West-wide RTO for the West as a whole, the study also quantified benefits for each Western state in the 2020 and 2030 timeframes. The 2020 study results showed that, relative to the status quo, a West-wide RTO could result in nearly $1.4 billion of annual savings (in 2022 dollars) had an RTO been operating at that time. By 2030, the study found that these gross benefits (i.e., benefits before accounting for any RTO-related costs) would increase to nearly $2.2 billion (in 2022 dollars) per year across the West.[25]

The state-level electricity cost savings from the *State-Led Market Study's* One-Market RTO were used as a key input in this study to help determine how households might be affected by increased spending power and how businesses might react to the competitive advantages of electricity prices that are lower than a status quo case. These benefits – and the subsequent quantification of economic impacts – should be considered conservative, as they only captured a subset of RTO-related benefit that may accrue to the West. The benefits also do not capture all potential outcomes and impacts to the West from an RTO (such as utility-level cost impacts) and, except for evaluating potential increases in clean energy resources in the region to meet large customer interests, do not assess other changes in the generation portfolio that may occur under an RTO.[26] While these caveats are recognized, the *State-Led Market Study's* state-level RTO-benefit quantifications were selected as the key inputs into this study as they are widely accepted across the industry as a good representation of potential benefits of the development of a Western RTO.

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system peaks, with adjustments made to account for resource sharing and transmission capabilities of the system.

[24] This study does quantify the anticipated benefits of construction of additional clean electricity resources to serve large energy users' needs, as discussed in Section 5.3. And, thus, there is a portion of impacts in this study that are attributable to a larger/accelerated build out of clean energy resources.

[25] Note that these figures differ slightly than what was reported in the *State-Led Market Study*. That difference is only due to this report's reliance on 2022 dollars and the *State-Led Market Study's* use of 2018 dollars as a reporting metric.

[26] Other changes in the generation portfolio could potentially occur as energy resource investment decisions shift between states. These shifts could also represent additional electricity cost savings that were not quantified as part of this study or the *State-Led Market Study*.

2.4 Goals of this Study

This study is intended to evaluate the potential economic benefits that might accrue to Western states from the development of a broad, West-wide RTO. Prior to this study, there was little information on the broader economic impacts that might result from the electricity price benefits and structural changes brought about by a potential future RTO in the region. The analysis in this West-wide report, and the forthcoming state-specific results, quantifies the expected impacts on job creation, economic development, business growth, induced economic activity, and economic diversification that may flow from operation of an RTO. The results reported herein include two broad channels of economic impacts: the direct effects, and multiplier effects of RTO development. Direct effects are those occurring directly from the economic impact, while the multiplier effect captures how that direct economic impact ripples through the economy and drives additional economic activity.

The primary goal of the economic modeling portion of this report is to provide an analysis of the range of total economic impacts to Western states from the development of an RTO in the region. In doing so, this study focused on quantifying: 1) the economic impacts associated with electricity cost savings from creation of an RTO resulting in increased spending power for households and 2) on new businesses/clean electricity generation that may be attracted to or expand in the West due to the formation of an RTO. In other words, the modeling framework and approach described in the remainder of this report helps answer the outstanding question of how RTO formation might be expected to impact the broader economy in the West. This study estimates economic impacts in three representative years: 2025, 2030, and 2035. Using these years help demonstrate the long-run trend of RTO benefits, including their sustained nature, over time. However, the report does not make an explicit assumption about when an RTO would be developed and the actual accrual of benefits and economic impacts over time, which will depend on when an RTO is formed. Additional study caveats and considerations are outlined in Section 7.2.

2.5 Organization of the Report

The report is organized into several sections. Which are described below:

- 3.0 Analytical Approach & Economic Modeling Tool: This section reviews the electricity cost savings results from the State-Led Market Study and how they were adjusted for use in this analysis. It also summarizes the economic input-output model used in the analysis. Finally, it provides an overview and definition of the key outputs that were taken from the modeling tool and reported in later sections to summarize the anticipated economic impacts of a Western RTO.

- 4.0 Economic Impacts from Increased Spending Power for Households in the West: This section outlines the assumptions, approach, and economic impacts that are expected to accrue

due to RTO-related electricity cost savings resulting in greater household spending power than would otherwise be expected under a "status quo" continuation of existing Western electricity markets.

- **5.0 Economic Impacts from New or Expanded Business Activity and Clean Energy Investments in the West:** This section outlines the approach used to estimate new business activity that may be attracted to Western states due to RTO formation, both due to structural changes an RTO would bring and as a result of the competitive advantage created by electricity cost savings for businesses in Western states. This analysis represents a novel piece of work which, inherently, involves uncertainty regarding the precise economic impacts that can be expected. To help account for this uncertainty, this section includes a low-end and high-end estimate of impacts to provide bookend ranges of potential economic impacts that may be expected to occur with RTO formation.

- **6.0 Total Range of Economic Impacts for the West:** In this section, the total direct and multiplier impacts in the West that are expected due to RTO formation are summarized. This includes both ongoing/permanent and construction/temporary impacts. Section 6.0 reports the combined economic impacts from Section 4.0 and 5.0 to arrive at a total range of anticipated economic impacts that the West might expect due to the formation and operation of an RTO.

- **7.0 Conclusion and Key Findings:** The study's key findings and conclusions, including the value of the total regional economic activity anticipated to stem from the creation of an RTO in the West, are reviewed in Section 7.0. This section also includes some considerations and caveats which are key to in interpreting the results of the study and in understanding its approach and limitations.

- **Appendix A:** This appendix summarizes the economic impacts from new, direct investments in RTO operation and administration that might occur in the West. The study did not assume these investments would occur in a particular state, but assessed several hypothetical, representative states; this section reports the range of results from that analysis. The results of this direct investment are reported for general awareness, and would be incremental to the results reported throughout this report, but they are not included in the total impacts of the RTO and are instead summarized separately in Appendix A. They would be incremental impacts to the Western state where the direct investment ultimately takes place.

3.0 ANALYTICAL APPROACH & ECONOMIC MODELING TOOLS

This section provides background on the analytical approach and modeling tools that were employed in the analysis. More specific details on the methodology (and results) of each portion of the analysis (impacts from greater household disposable income and impacts to businesses/clean energy) are detailed in Section 4 and 5.

3.1 Quantifying Future Electricity Cost Reductions

In order to conduct the economic impact assessments using the input-output model, IMPLAN, (described more in Section 3.2), it was first necessary to quantify, on a state-by-state basis, the overall expected electricity cost savings anticipated to occur with an RTO (as compared to the status quo) and the percentage impact of those savings. To better reflect electricity price impacts that are expected to occur due to RTO formation, this study estimated the state-level incremental cost of operating and administering an RTO across the West and netted this cost from the state-by-state gross benefits estimated in the *State-Led Market Study*. This section briefly describes the sources and assumptions that were employed to arrive at the electricity cost savings that were, in turn, used to inform the economic impact assessment.

QUANTIFYING GROSS BENEFITS OF A WESTERN RTO

The *State-Led Market Study*, completed in 2021 after a stakeholder and study process that lasted over two-years, provided a state-by-state (and West-wide) estimate of the annual electricity cost savings that could be expected from the formation of a West-wide RTO in both 2020 and 2030.[27] These benefits represent the gross wholesale operational and capacity savings expected with an RTO, as compared to the "status quo" of real-time energy market operations (including both the WEIM and the WEIS).

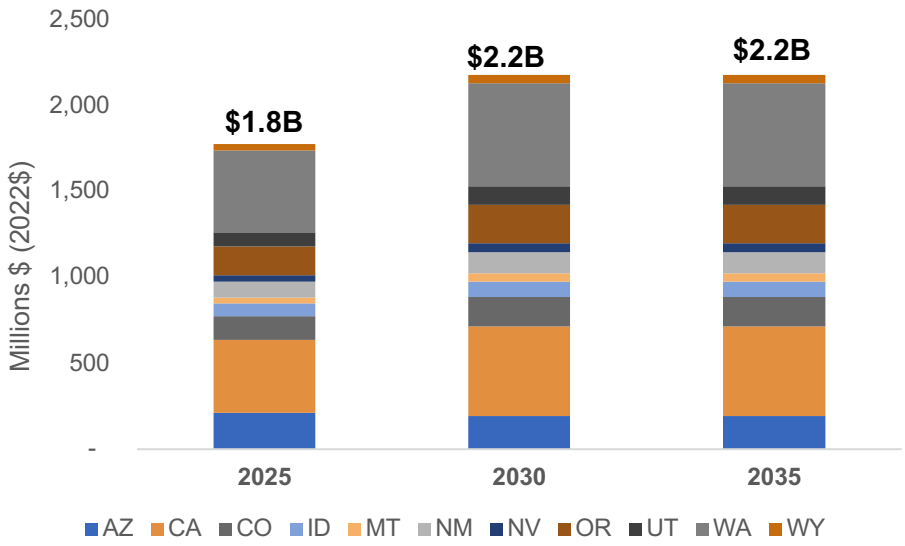
[27] Specifically, state-level benefits for 2020 can be found by summing the state-level results for a "One Market RTO" found in Figure 23 and Figure 25 of the *State-Led Market Study Technical Report*. And 2030 state-level figures can be found in Figure 24 and 26.

In order to use these savings as inputs into this current study, the state-by-state benefits for the 2020 and 2030 timeframes were adjusted from 2018 dollars to 2022 dollars.[28] The results of the *State-Led Market Study* were also interpolated and extrapolated from 2020 and 2030, in order to estimate electricity cost savings from an RTO for the representative years of 2025 and 2035 that are reported here. Specifically, the 2025 benefits estimate for each individual state is the mid-point between the 2020 and 2030 benefits from the *State-Led Market Study*. Because 2035 benefits were not quantified as part of the *State-Led Market Study* effort, this study simply assumed that gross benefits in 2035 would remain flat at the 2030 level. There are competing forces that may drive gross state-level RTO benefits in years beyond 2030 higher or lower than the 2030 quantification. Without performing underlying energy market analysis to quantify expected benefits in later years, it was deemed reasonable by the study team to assume that capacity savings would remain relatively flat, while operational savings may go up or down depending on the specific situation of a state and how that state benefits from lower marginal cost resources and pays for higher priced periods in the market. Thus, the decision was made to hold the anticipated gross benefits of RTO operation flat between 2030 and 2035.

The gross, region-wide benefits from RTO operation in 2025, 2030 and 2035, after making these adjustments, are shown in Figure 3-1 below. It is important to reiterate that the individual years should be viewed as representative of the overall trend in RTO-related benefits over time, as this study is not assuming a specific year in which RTO creation would occur.

[28] Note that the research and analysis for this study began in 2021 and relied on projected inflation rates developed in 2020, which turned out to be conservative for the 2021/2022 timeframe. See Consumer Price Index data reported by the Social Security Administration here: https://www.ssa.gov/oact/tr/2020/lr5b1.html.

Figure 3-1 Gross Benefits of a West-Wide RTO
(Adjusted and Extrapolated from the State-Led Market Study)



COSTS OF OPERATING/ADMINISTERING AN RTO

The goal of this economic analysis is to, as accurately as possible (given the large geographic scope and broad nature of the analysis), assess the economic impacts that are anticipated due to an RTO offering lower electricity prices than would otherwise occur. While this report cannot quantify individual utility-level impacts or "net benefits" of an RTO, it does adjust gross RTO benefits for the anticipated, ongoing operational or administrative costs associated with running an RTO. Accounting for these costs helps to better reflect actual RTO savings that are likely to accrue to ratepayers in the region.

Markets, such as RTOs, will have costs associated with their ongoing administration and it is important to consider these costs alongside the benefits the market may offer. The administrative/operational RTO costs evaluated in this report are intended to include costs for software and office-related costs of setting up and running the RTO, as well as the costs for staff to help operate the market, conduct appropriate stakeholder processes, making regulatory filings, etc.

The *State-Led Market Study* reported a relatively large range of possible estimated operational/administrative costs for a Western RTO. The *Western RTO Economic Impact Study* sought to arrive at a conservative single-point estimate of the potential incremental administrative

costs of standing up and operating an RTO in the West which was, in turn, subtracted from the gross RTO benefits on a state-by-state basis. [29]

A number of sources were reviewed to inform the estimate of RTO administrative/operational costs used in this study, including the 2021 Common Metrics Report from the Federal Energy Regulatory Commission (FERC).[30] Based on that report, average costs that ISOs/RTOs billed over the 2014 to 2018 timeframe ranged from a low of $0.41/MWh (in 2022 dollars) for PJM Interconnection to a high of $1.58/MWh for ISO-New England.[31] ISOs and RTOs benefit from economies of scale and, the more load that an RTO serves, the more units of energy/transactions there are to spread administrative costs over. For this reason, the approximate load served by each ISO and RTO was also assessed to help inform what the operational costs (per unit of energy) might look like for an RTO similar in size to a potential future West-wide RTO. The two ISOs/RTOs that are closest in size to a hypothetical West-wide RTO are the Midcontinent ISO (MISO) and PJM Interconnection. Based on the FERC 2021 Common Metrics report, MISO's administrative/operational costs were around $0.44/MWh (2022$), while PJM's were around $0.41/MWh (2022$). The study team also reviewed other sources of RTO/ISO operational cost estimates for past RTO expansion efforts, which would yield a lower average cost per MWh than the average costs for MISO and PJM discussed above.

[29] As discussed more below, this calculation is relatively straightforward for all states except California. California already pays to operate an RTO and the economies of scale afforded by a West-wide RTO may actually reduce the market operator costs that Californians pay today, in effect increasing the benefit of West-wide RTO operation for California.

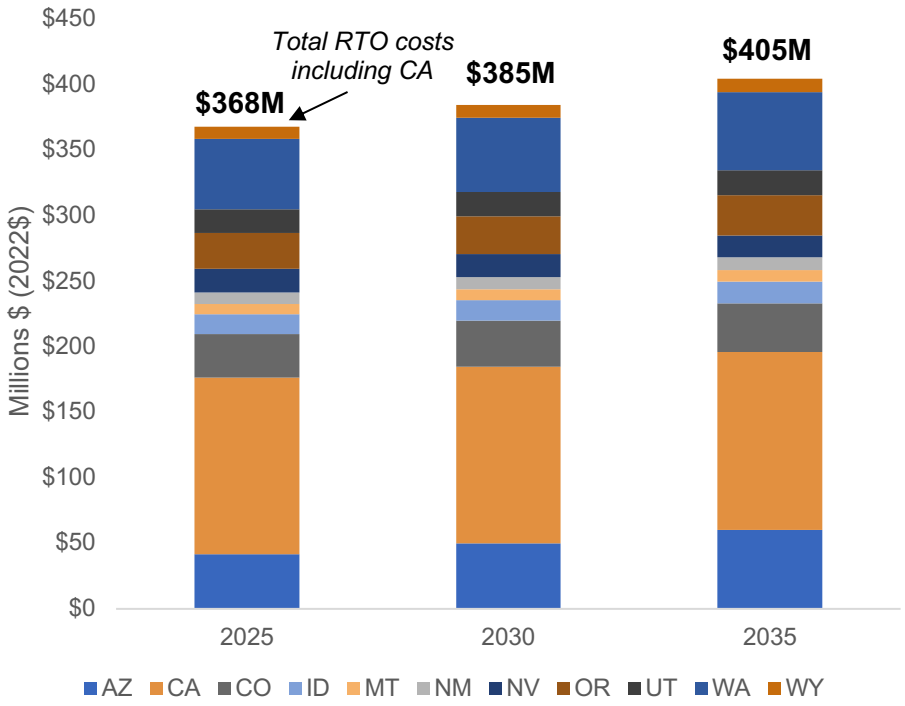
[30] *2021 Common Metrics Report: Performance Metrics for ISO, RTOs and Regions Outside ISOs and RTOs for the Reporting Period 2014 to 2018;* FERC Staff Report; docket No. AD19-16-000; published July 23, 2021; available here*:* *https://www.ferc.gov/media/2021-common-metrics-docket-no-ad19-16-000-staff-report*

[31] NYISO had the lowest "Admin Cost Billed" as reported in the FERC Commission Metrics Report, but NYISO was left out of this report's assessment of market operator costs, because the NYISO data point was an extreme outlier compared to other market operators and appeared likely to be an anomaly. Also note that the range of operational costs reported here has been converted to 2022 dollars.

Using these estimates as a guide but desiring to be relatively conservative with respect to potential RTO-operation estimates, this study assumed a flat $0.50/MWh incremental cost for RTO operations for a West-wide RTO. An RTO operational cost for each state was calculated by multiplying their anticipated load in a given year by the $0.50/MWh RTO cost.[32]

The total, West-wide operational or administrative costs associated with running the RTO are illustrated in Figure 3-2, below. These costs represent ***total*** costs across the West and would, therefore include costs that are already paid by customers within an existing RTO/ISO market footprint in the West.

Figure 3-2 Total Assumed Annual Operational Costs for a West-Wide RTO



[32] Many utilities in the West already participate in one of the already operating energy imbalance markets (WEIM or WEIS), which also have an administrative cost associated with their ongoing operations. If a West-wide RTO were established, those utilities would no longer need to, separately, pay for the costs of operating an energy imbalance market. Thus, if a full RTO were implemented in the region, there would likely be cost savings to individual utilities, and associated states, from reduced costs of administering an energy imbalance market. However, those cost savings were not specifically calculated and accounted for herein. Rather, all utilities were assigned an incremental $0.50/MWh cost for RTO participation, which (in effect) can be thought of an incremental cost to operate an RTO. Given this approach, the $0.50/MWh cost assumed for RTO operations is likely a conversative estimate, and the incremental costs utilities and states see to operate a West-wide RTO may actually be lower.

As discussed more in Appendix A, the incremental costs of RTO operation (above and beyond what is already spent in the region on RTO operations) would also represent an investment in the location in which they ultimately occur. These incremental investments, which are less than what is shown in Figure 3-2 (as that figure includes existing costs of operating an RTO in California) will have their own set of positive economic impacts. A range of potential economic impacts is presented in Appendix A based on an analysis of hypothetical states where incremental direct RTO investment might occur.

ELECTRICITY PRICE BENEFITS NET OF RTO OPERATIONAL COSTS

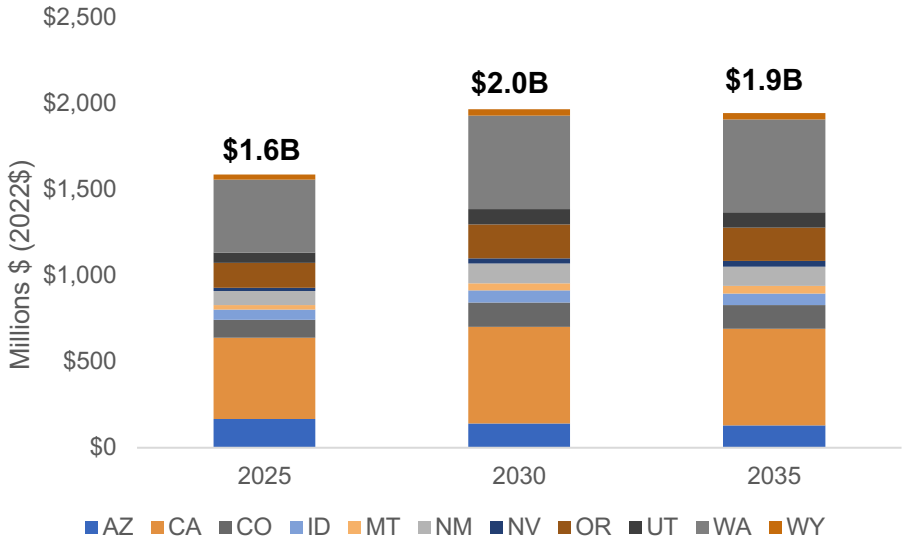
To arrive at inputs for use in the remainder of the analysis, this study netted the gross RTO benefits from the *State-Led Market Study* for each Western state with that state's estimated, incremental cost of establishing and operating/administering an RTO. To calculate state benefits, net of RTO operational costs, the gross RTO benefits by state were reduced by the anticipated operating and administrative costs electricity consumers are expected to pay for the RTO ($0.50/MWh). The resulting calculations represent the anticipated reduction in electricity costs a state is assumed to observe due to West-wide RTO formation, compared to the status quo of energy market operation in the West. [33] The RTO benefits net of operational costs across the West are illustrated in Figure 3-3 below.

For most states, accounting for the costs of RTO operation results in a decrease to their gross benefits. However, because most of California's electricity load already pays to operate an RTO, California is expected to have an *incremental* benefit due to West-wide RTO operations. California ratepayers would benefit from the economies of scale of a West-wide market reducing the cost per MWh of operating the market, and providing additional cost savings to ratepayers within the state. The cost savings to California are the difference between what load within the state the is expected to pay for RTO operations under a status quo case compared to what the entire state would pay to fund RTO operations at $0.50/MWh. The net benefit to California, as a result of these economies of scale, is expected to be approximately $42 million per year. In other words, California is expected to pay $42

[33] The calculated benefits, net of RTO operational costs, do not account for all potential costs of RTO formation/operation that might affect individual utilities or states. For instance, utility-level investments and staffing costs that may be required to participate in an RTO are highly dependent on the specifics of a utility's situation. These costs have not been analyzed and netted from gross benefits in this study. Additionally, transmission cost shifts that may occur due to RTO formation (eliminating the need for one utility to pay another utility to utilize their transmission system) have not been evaluated in the context of this study. These transmission costs shifts could increase benefits from RTO formation for some utilities/states, while decreasing them for others. However, across the Western region as a whole these increases and decreases in benefits due to transmission cost shifts are expected to net to zero. Additionally, while transmission cost shifts, implementation costs, and other factors will be critical considerations for individual decisions to participate in these markets, their effects will, in many cases, depend on the RTO's market design and implementation, which are topics beyond the scope of this analysis.

million less in operational/administrative costs for market operations under a West-wide RTO than they would be expected to pay if market operations remain relatively static.

Figure 3-3 Benefits of RTO Operation Net of Incremental RTO Operational Costs in the West



Additionally, to support the evaluation of new/expanded businesses in the region due to lower electricity prices, these benefits were translated from dollar amounts into approximate percentage impacts on retail electricity prices on a state-by-state basis.[34] Those percentage reductions were used as an important input into the estimates of new businesses that might be attracted to the West, which is described in more detail in Section 5.2.

3.2 Economic Modeling Tool & Methods

An economic input-output model was utilized to assess the economic impacts of the electricity price changes that are expected, should an RTO form in the region. The data utilized within the input-output model were sourced from the Bureau of Economic Analysis (BEA) and encompass over 500 unique industries. Input-output models can be used to help understand the interconnected nature of industries within an economy. They are used to understand: 1) bottle-necks to regional economies, 2) how those economies are likely to evolve in the short-run as constraints in the supply chains are relaxed,

[34] Simplified percentage impacts on electricity prices (relative to the status quo) were calculated using 2020 average retail prices for each state (as reported by the Energy Information Administration) multiplied by approximate 2020 retail sales to determine approximate total expenditures on electricity in each state. And the percentage impact is the percentage of an individual state's RTO savings relative to that total cost.

and 3) how economies are expected to expand or contract as changes occur. These models represent an economist's version of an industry-by-industry accounting system, and it is through these models that the flow of dollars can be traced through the economy. That is, the spending by one business in a transaction becomes the income of other businesses. That process continues until the money exits the economy to purchase goods and services from outside the region. The sum of all rounds of spending and income within the region is referred to as the multiplier impacts.

This study uses the most widely available commercial input-output model: the IMpact-PLANing or IMPLAN model.[35] IMPLAN provides regional labor market and economic data in a database structured to facilitate input-output accounts and models. There are several limitations surrounding the use of input-output models such as IMPLAN. The first is that they reflect regional economies as they currently are and, absent the forecasted changes, economies are assumed to remain relatively static.[36] The models do not account for prices and quantities directly, but instead show the value of transactions. Finally, the data within the models are not based on the specific firms within the regional economy and instead reflect standard production technologies. Despite these caveats, input-output models provide useful insights into anticipated economic impacts of various changes (such as reduced electricity prices) and are widely used across many industry and policy forums.

To conduct the analysis for the Western region, 11 individual state-models were constructed in IMPLAN (one for each Western state). The sum of the economic impacts across these 11 state-models is what is reported in this study. The individual IMPLAN state-models were constructed using data from the most current model year (2020) and were used to analyze the economic contributions expected from RTO formation for each of the Western states. The use of 11 individual state-models (which are then aggregated to determine the total impacts on the West) results in a conservative assumption regarding the multiplier effects described above and thus likely reports lower overall economic impacts than would have been reported if a single Western model had been utilized. However, the use of individual state models was selected as it allows for inter-state differences in, and more accurate estimates of, business formation impacts.

In addition to IMPLAN, other economic datasets were utilized to inform this study, including the Emsi database. Emsi is the leading labor market information company in the United States, providing detailed, unsuppressed, demographic information. [37] Emsi's labor market information allows users to identify, at a regional level, a variety of information regarding the labor force. Of particular use in preforming this analysis were Emsi's detailed industry, occupation, and wage data. Additionally, Emsi data was relied on extensively to report percentage impacts and help provide context to the economic

[35] IMPLAN. Economic Impact Analysis for Planning, additional information found here: https://implan.com/ .
[36] This is why the analysis described in Section 5 of this report was necessary and conducted first outside the model.
[37] Emsi - Labor Market Analytics & Economic Data; additional information available here: https://www.economicmodeling.com/

impacts resulting from this analysis and in the state-by-state competitive analyses (discussed in Section 5.2).

3.3 Model Outputs

The economic impacts that may be expected to accrue as a result of RTO operation in the West are summarized in this report using the following metrics, which are outputs of the IMPLAN model.

- **Gross State/Regional Product –** Gross State Product (GSP) includes employee compensation, proprietor income, taxes on production and imports, and other property income; it excludes the value of intermediate inputs. GSP is a more conservative, and accurate, measure of impact than output (or sales), which are not reported here. GSP is more accurate because it only quantifies the value-added produced by companies, i.e., it includes no double counting. Gross Regional Product (GRP) is used to denote the combined GSP impacts across the 11-state region.

- **Total Compensation –** Represents wages, salaries, and benefits collected by employees, contractors, and other paid workers due to the economic impacts modeled. This category excludes income accrued to owners and investors and may also be called labor income.

- **Employment (or Jobs) –** IMPLAN's employment estimates are in terms of full-time equivalent (FTE) positions. For construction jobs, employment is in terms of job-years (i.e., equivalent number of full-time persons employed over the course of one-year).[38] Jobs are reported as "temporary/construction" or "permanent/ongoing," depending on the nature of the impact.

- **Total Indirect Taxes –** For this study, taxes are inclusive of property, sales and excise taxes at the state and local levels. IMPLAN's model accounts for many state-specific nuances in tax collections; however, an in-depth/project specific tax assessment was beyond the scope of this study. The tax impacts reported herein should be thought of as estimates and do not precisely account for all tax nuances that may exist on a state-by-state or municipal level.

[38] For example, if a project were to be equally spread over two years and there was a total of 100 job-years, then there would be 50 job-years reported for each of the two years.

4.0 ECONOMIC IMPACT FROM INCREASED SPENDING POWER FOR HOUSEHOLDS

This section of the report is focused on the economic impacts to the West that occur from households having higher disposable incomes resulting from lower electricity prices due to the cost savings, relative to the status quo, created by an RTO.

4.1 Technical Approach & Considerations

As discussed in Section 3, the formation of an RTO is expected to reduce electricity costs in the West by about $2 billion annually in 2030, after accounting for the likely costs of operating the RTO. The reduction in electricity costs, compared to what they otherwise would be, will drive increased economic activity across the region. These electricity cost savings, which can also be thought of as efficiency gains, were modeled in IMPLAN as energy price reductions for households. [39]

Input-output models, such as IMPLAN, are not built on the basis of prices, but rather on the basis of values transacted in a regional economy. For this reason, electricity cost savings/price reductions from their status-quo level can be modeled within the input-output framework as an increase in household income. Electricity cost savings will become increased disposable income for households which will, in turn, become available to households for expenditures on other goods and services in the economy.[40] Suppose household purchases are broken up into two goods: energy and all other spending. If there is a drop in energy prices, households can use the savings they realize to increase their consumption of all other goods. For instance, if energy costs savings result in a household saving $200 per year,

[39] Actual benefits would be expected to flow through to both households and businesses. Businesses can either pass along those savings to consumers or may see increased profits flow to the owners of the business. In the latter instance, increased profits to owners of a business eventually flow through the economy to households. And, thus, the reductions in electricity prices in the West will ultimately flow to households through one channel or another and are modeled as such in this portion of the analysis.

[40] Even in the event that some portion of the RTO-related savings do not make their way to end-use electricity customers, even utility shareholders/owners are (at the end of the day) households who will have increased spending power. Thus, the electricity cost savings associated with an RTO will still make their way to households in the form of higher disposable income.

then, all else equal, that household can increase their food, entertainment, or retail expenditures by $200.[41]

It is worth noting that, even in the case where money is saved by a consumer (and not immediately spent on other goods/services), the bank holding that account will lend out the savings, which will still result in an increase in current expenditures within the economy. In the example above, if the $200 per year saved on electricity were put into the bank by the household, the bank would still be able to lend that money out, which would have a ripple effect in the economy, similar to if the household had spent the money, which input-output models are designed to capture.

To quantify the economic impacts within the Western region, the anticipated electricity cost savings described in Section 3.1 must also be adjusted to account for "leakage" out of the region. Leakage, in this context, occurs when the savings a household accrues from lower electricity costs results in spending on goods and services outside of the economic area being evaluated. That external spending provides no additional multiplier effects within the Western states being studied here. Moreover, although households are similar across states, their spending patterns do differ. The state level input-output models account for household spending patterns, including what portion of household spending occurs on out-of-state and overseas purchases. Much of the data surrounding household spending comes from the Consumer Expenditure Survey conducted by the Bureau of Labor Statistics. For this analysis, approximately 26% of the electricity cost savings for each state was estimated as likely to be lost to leakage, based on input-output model data.[42]

After making the adjustment for leakage, IMPLAN was utilized to estimate direct and multiplier activity attributed to an increase in household expenditures that can occur when electricity prices in the West are lower with an RTO than they otherwise would have been. The results include expected increases in Gross Regional Product, increased income from new jobs, and additional permanent tax revenues across the region, which are summarized below.

4.2 Economic Impact Results from Increased Household Spending Power

There are positive net economic benefits to the West as a result of the increased spending power for households due to lower electricity prices afforded by an RTO. The analysis shows that, after accounting for leakage, the increased spending power provided from RTO-related electricity cost

[41] Based on price elasticities, we would also expect household to increase their expenditures on electricity, perhaps even moving faster towards electrification. But those impacts are not expressly analyzed in this study.
[42] The national leakage metrics were utilized (i.e., 26%) because of the large geographic and economic footprint being evaluated in total and to account for intrastate trade between the Western states.

savings, will help support nearly 18,000 additional permanent jobs across the region, with total compensation of over $1 billion per year, in the 2030 timeframe. Additionally, in the 2030 timeframe, these savings will support an increase in Gross Regional Product of nearly $1.8 billion. These jobs also result in new permanent tax revenues, through indirect business taxes, of $108 million per year in 2030, as illustrated in Table 4-1, below.

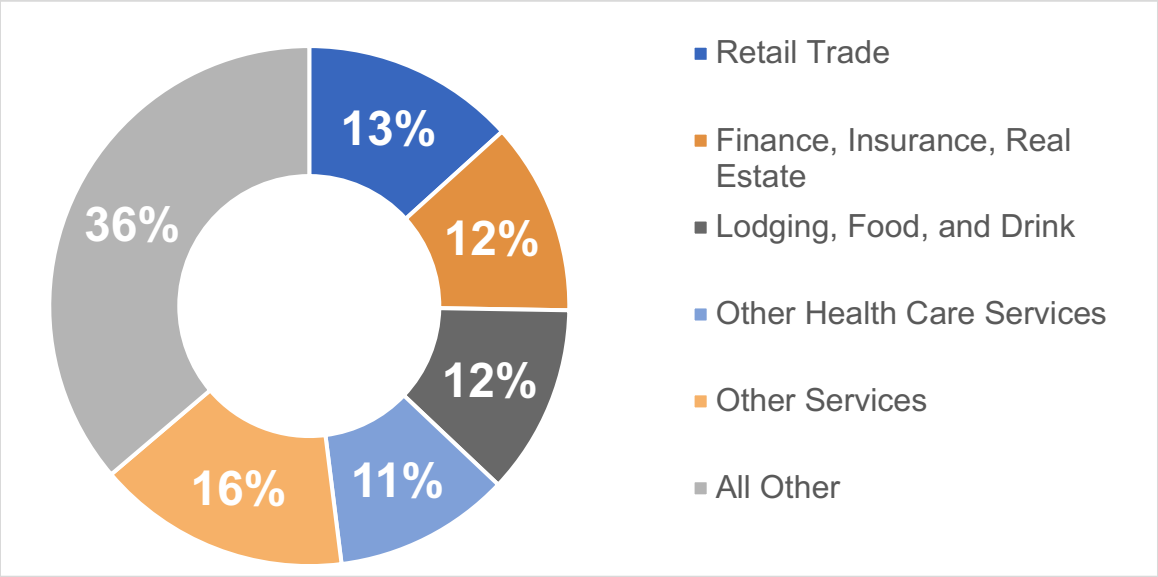
Table 4-1 Annual Economic Impact from Increased Spending Power for Households due to an RTO

West-Wide Economic Impacts from Increased Spending Power for Households	2025	2030	2035
Pre-Leakage Electricity Cost Savings (Millions 2022$)	$1,590	$1,970	$1,947
Post-Leakage Electricity Cost Savings (Millions 2022$)	$1,183	$1,466	$1,448
Gross Regional Product (Millions 2022$)	$1,452	$1,791	$1,770
Total Compensation (Millions 2022$)	$850	$1,048	$1,035
Total New Ongoing Jobs (FTEs)	14,408	17,807	17,585
Total Indirect Taxes (Millions 2022$)	$87	$108	$107

The top five industries[43] that are affected by increased spending power for households, and which see new employment created across the West, are illustrated in Figure 4-1.

[43] Industry names are reflective of the North American Industry Classification System (NAICS) two- and three-digit codes.

Figure 4-1 Jobs Created (2030) from Increased Spending Power for Households due to an RTO



5.0 ECONOMIC IMPACT ASSOCIATED WITH NEW OR EXPANDED BUSINESS ACTIVITY AND CLEAN ENERGY INVESTMENT

This section of the report provides an estimate of benefits that are distinct from, and incremental to, the benefits assessed in Section 4. Whereas Section 4 focused on the increased overall economic activity of households due to increased disposable income from lower electricity prices created by RTO formation, Section 5 looks explicitly at the potential for increased economic activity from new business formation, and business growth, that could occur with the operation of an RTO across the West. In other words, Section 4 focused strictly on the increased economic activity of current actors in the economy, whereas Section 5 focuses on the additional actors that might be drawn to or expand in the region and the economic activity associated with that. These types of impacts, from "new actors," are not explicitly captured in the multiplier effects and impacts discussed in Section 4, which only capture the impact of from higher disposable income that flows through the existing economy.

This analysis employed two approaches to help estimate the new business activity that may be attracted to the region as a result of RTO formation:

(i) Additional/expanded business activity from the competitive advantages offered by lower electricity costs (discussed in Section 5.2)

(ii) Additional clean electricity generation development to meet large energy users' sustainability and clean energy goals (described more in Section 5.3).

5.1 Introduction & Bookend Approach

This portion of the analysis is more novel than the assessment described in Section 4 and, accordingly, there is increased uncertainty associated with how businesses will react in response to lower electricity prices and new contracting structures that would be available under an RTO in the West. To reflect this uncertainty, both low-end and high-end cases were developed to bookend the anticipated range of economic impacts that might be expected. The actual economic results that are experienced, both region-wide and on a state-by-state basis, will ultimately depend, among other factors, on how benefits

flow through to businesses, how sensitive businesses are to lower electricity prices (compared to what they otherwise would be), and on how many additional clean energy resources are developed to serve large-customers' interest in procuring clean energy through the new market structures provided by an RTO.

5.2 New and Expanded Business Activity from Lower Electricity Prices

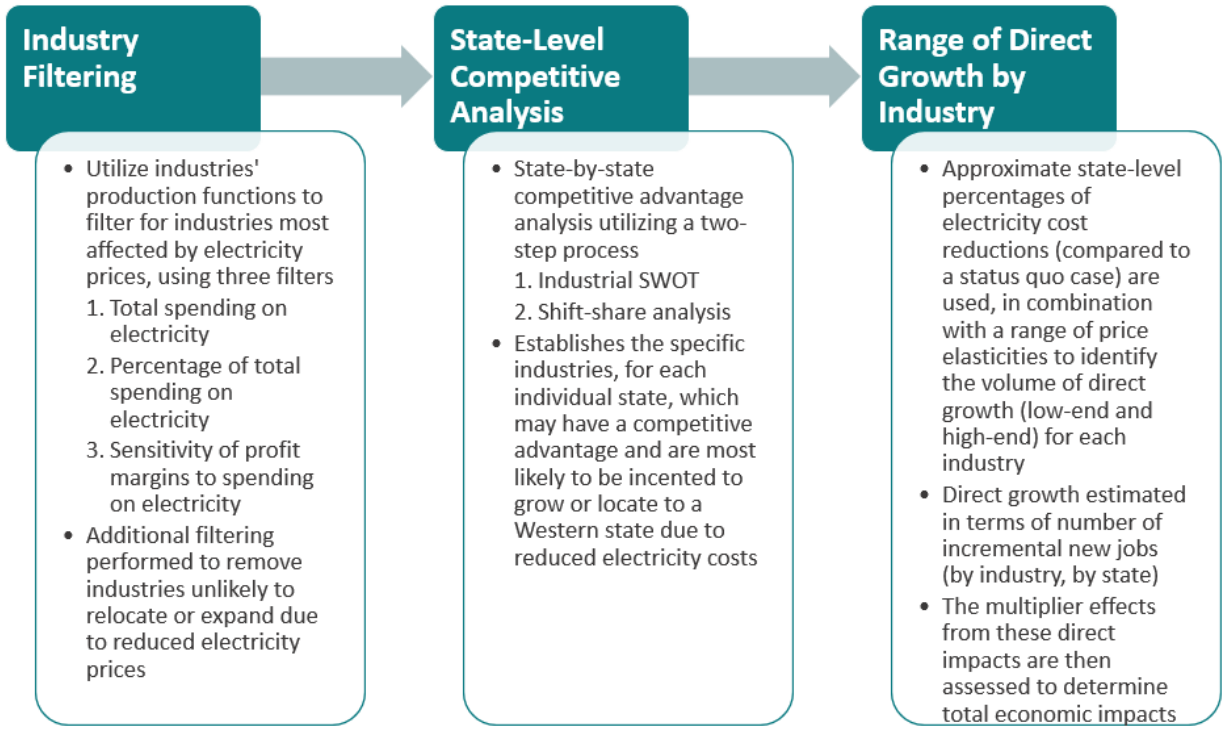
For many firms, energy is a major expense and reductions in energy costs represent an improvement in business climate and provide the opportunity for higher profits. Lower electricity prices can drive increased business activity for firms that are most affected by electricity prices. This section discusses the approach utilized to estimate increased business activity across each of the 11 Western states included in this study. Three distinct business types, which may be affected by lower electricity prices, were included in this portion of the analysis:

1) Firms that expand within a given state,
2) New business creation or start-ups that emerge, and
3) Out-of-state firms that opt to relocate to a Western state as a result of the reduced energy costs and improved business climate afforded by the formation of an RTO.[44]

The approach to identifying affected industries and anticipated direct growth in those industries was employed individually for each state and generally followed three steps, which are outlined (at a high-level) in Figure 5-1 below.

[44] As discussed more below, while this type of business relocation is possible, is expected to be fairly unlikely to occur and a minimal contributor to business growth in the region.

Figure 5-1 Process for Determining Industry Impacts from Reduced Electricity Prices with an RTO



This approach was undertaken, individually, for each of the 11 Western states and the resulting impacts across the states were aggregated and are summarized in this report. Because individual IMPLAN state models were used, the multiplier effects reported from this analysis are likely conservative across the region and do not fully account for multipliers that would occur between states.

This methodology reports the aggregated impacts to the West for new/expanded businesses for all states. Changes to electricity prices under an RTO, compared to the status quo, are also likely to cause changes in relative electricity prices between the Western states. While intra-regional business movement (i.e., movement of businesses from one Western state to another) is possible, it is unlikely for two reasons. First, businesses currently operating in the West will benefit generally from the presence of an RTO and lower electricity prices than the status quo, making their operations more profitable (and providing additional incentives to remain located in their applicable Western state or states). Second, the costs of moving a business across state boundaries is costly. The energy price differential between states would need to overwhelm the costs of moving the business, which is unlikely except in extreme examples. Thus, the growth in industries identified in the analysis described below are expected to come from new or expanded businesses in the Western states, as opposed to companies moving existing operations within the West.

INDUSTRY FILTERING

In order to focus on the industries most likely to be affected by changes in electricity prices, the IMPLAN dataset was employed to understand how each industry within the state is affected by electricity prices.[45] The goal was to filter industries to eliminate those that are unlikely to be substantially affected by changes in electricity prices and to identify the subset of industries that are good candidates to expand in one of the Western states. In order to do this, three filters were used. Industries that rose to the top of these three filters were considered in the state-by-state competitive advantage analysis described in the next subsection.

The three filters analyzed for the initial industry filtering process were:

1. Total spending on electricity
2. Percentage of total spending on electricity
3. Sensitivity of profit margins to electricity costs

These three filters are designed to capture, respectively, large energy consumers, energy consumers that are dependent on or have a large share of their production expenditures in energy, and those industries that are particularly profit sensitive to energy prices.

After applying these filters and beginning to hone in on industries that are most likely to be affected within each individual state, additional screens were employed to help filter out industries which may fit into one or more of these three categories but which are unlikely to be substantially impacted by expected electricity price changes. For instance, industries that are natural resource dependent and will locate where the natural resources are situated (such as forestry and mining) were generally excluded from further consideration, as the location and availability of the natural resources, rather than electricity prices, may be the most critical factor in where these businesses locate or expand. Additionally, industries that serve residents, such as nursing care facilities, hospitals, food service, and retail/wholesale trade were also generally excluded. Another category of exclusions was "specialized services" such as postal services, engineering/technologies, monetary authorities, and insurance industries.

After performing these screens and additional filtering, a competitive advantage analysis was undertaken for the remaining industries in each state, as described more below.

[45] For purposes of this work, industries were captured at the 4-digit NAICS code level, which was selected to provide an appropriate level of detailed results without the need to evaluate excessive industry level data/detail.

STATE-BY-STATE COMPETITIVE ADVANTAGE ANALYSIS

To better isolate the industries most likely to grow, emerge, or relocate to the West as a result of the RTO, each state's competitive advantage was determined by industry.[46] Each state's competitive advantage was calculated in two ways:

1. Industrial Strength, Weakness, Opportunity, Threat (SWOT) analysis; and
2. Shift Share Analysis[47]

This process allowed for identification of each state's competitive environment by industry and gives insight into where industries will be most profitable i.e., where in the West those industries will be most likely to emerge or expand.

The first component is an Industrial SWOT analysis considers each industry's concentration, relative to the U.S. as a whole. This calculation uses a measure of concentration known as an industry's location quotient (LQ). If an LQ is greater than one, that industry is more concentrated in the region (or state) being evaluated than it is nationally. A good example, to illustrate how LQs work is to look at Napa Valley in California. Napa Valley has a LQ for wineries of over 900, which indicates that Napa Valley has 900 times the concentration of winery jobs than the U.S. as a whole. The change (growth or decline) of an industry's LQ within a state or region can also be a good indicator of the competitive advantage of a state or region with respect to that industry.

Figure 5-2 below illustrates a sampling of industries within the state of Colorado to help demonstrate how LQs and changes in industry concentration were used to designate industries as a strength, weakness, opportunity or threat. An industry that is highly concentrated (high LQ) and growing is classified as a strength and often referred to as a pillar industry. For the state of Colorado, data centers and furniture manufacturing are strengths. Threats represent those industries that are highly concentrated but losing that concentration. The medical equipment/supplies manufacturing industry is classified as a threat category in Colorado. Colorado is abundant in opportunity industries, which are those with low, but growing, concentrations and includes architectural metals manufacturing. Industries with low concentrations which are shrinking are classified as weaknesses for a state or region. In Colorado animal processing is a weakness.

This exercise was performed for each of the 11 Western states in this study. For each state, industries identified as a strength or opportunity, and which also passed the initial screening, were classified as industries where changes in electricity prices may cause business growth.

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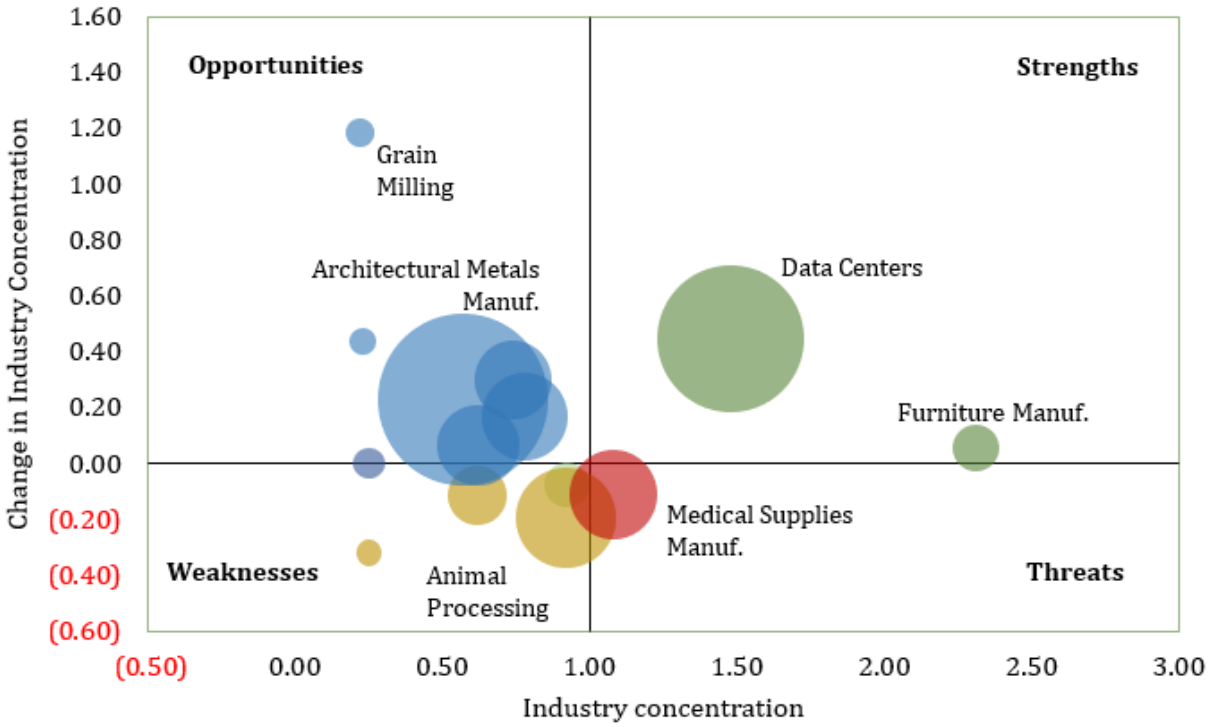
[46] The Emsi database was relied on to support the regional competitive analysis described herein.

[47] Goetz, Stephan, Steven Deller, and Tom Harris (2007) Targeting Regional Economic Development: An Outline of a National Extension Educational Program. *Rural Development Paper* No. 38.

Figure 5-2 Illustrative Example of an Industrial SWOT for Select Colorado Industries[48]



Industries identified by the Industrial SWOT, described above, were then evaluated according to a "Shift Share" analysis which compares an industry's actual growth in a state or region with its expected growth. The difference between actual and expected metrics represents the competitive advantage the region provides to the industry.

Shift Share analysis may be best explained by considering an example. Several representative industries for the state of Colorado are used to demonstrate the primary results from a Shift Share analysis. The first step in the analysis is to calculate each industry's "expected change." While this can be done using any desired metric, we have opted to demonstrate the process using jobs. The expected change in industry employment is calculated by summing two metrics: the industry mix effect (i.e., the percentage change in industry employment nationally), and the national growth effect (i.e., the percentage change in national employment). These two metrics are designed to capture overall growth, under industry specific dynamics, and the rising tide lifts all boats argument. The sum of the industrial mix and national growth effects yield the "expected movement" for each industry. The difference between the actual change, and the expected change results in the regional competitive advantage. For example, data processing was expected to grow in Colorado by 3,079 jobs between 2010 to 2020, but the industry actually grew by 8,592 jobs, 5,512 higher than expectations. This shows

[48] The size of the circles in Figure 5-2 represents the size of employment for a given industry in the state.

the region possesses some competitive advantage in data processing because it is evolving faster than national trends would suggest it should. In general, under a Shift Share analysis, if the actual job change is greater than the expected change, we say the state provides a competitive advantage to that industry.[49]

Shift share is valuable because it moves us past the simple assumption that "any growth is good growth." For instance, wood products manufacturing in Colorado grew by 269 jobs from 2010 to 2020, but that was 46 jobs less than expectation. So, even though the industry grew, the state underperformed. Cut and sew apparel lost jobs, but at a much slower rate than expected, meaning the region provides the industry more resilience than elsewhere. Lastly, the medical equipment and supplies manufacturing industry lost jobs when it was expected to grow. This indicated that Colorado is at a competitive disadvantage for the industry overall.

Table 5-1 Illustrative Example of Shift Share Analysis for Select Colorado Industries

Industries Description	Industrial Mix Effect	National Growth Effect	Expected Change	2010 - 2020 Change	Competitive Effect
Data Processing, Hosting, and Related Services	2,546	534	3,079	8,592	**5,512**
Cut and Sew Apparel Manufacturing	(268)	46	(222)	(38)	**184**
Medical Equipment and Supplies Manufacturing	(359)	498	139	(79)	**(218)**
Other Wood Product Manufacturing	121	194	315	269	**(46)**

This type of Shift Share analysis was utilized to further vet industries within each state to determine which industries have a competitive advantage. Industries with a competitive advantage in the Shift Share analysis were considered eligible industries for potential direct growth from lower electricity prices. Thus, the resulting list of industries from the Industrial SWOT and Shift Share were assumed to be those industries most likely to benefit from the electricity cost savings from an RTO. They were then further assessed to determine their likely quantity of growth in each Western state.

[49] The competitive advantage captures, agglomeration, co-location, thick labor markets, and all other types of causal influences on the industries.

RANGE OF DIRECT GROWTH BY INDUSTRY

To estimate the job changes afforded by the electricity cost savings associated with an RTO, average energy price reductions (calculated as described in Section 3.1) were multiplied by the price elasticity of location and growth. Price elasticities show how sensitive one variable is with respect to changes in price. In this case, we evaluated how sensitive a business's location or growth decision is relative to electricity prices. An elasticity of 1 is referred to as "unit elastic" and means that a 1% change in price will lead to a 1% change in volume. Measures of elasticity between 0 and 1 are considered inelastic, that is, a 1% reduction in price will lead less than a 1% increase in volume. Measures of elasticity greater than 1 are considered elastic, meaning 1% decrease in price will lead to a greater than 1% increase in volume.

To determine the elasticities used in this analysis, a substantive review of literature was conducted.[50] The review indicated that there is a wide range of elasticities depending on the specific motivation of the growth or relocation. As such, we provide a range of results in this study based on a range of elasticities. This range reflects the upper and lower bound expectations of growth resulting from the RTO and expected electricity price reductions. While the distribution of growth is not known, the authors hypothesize that the distribution of growth is likely to be skewed to the lower bound in most cases, as the distribution is not symmetric around the mean. For the low-end case, an elasticity of -1.3 was used, implying that a 1% reduction in electricity prices would lead to a 1.3% increase in the industry's growth within the state. An elasticity of -5.9 was used for the high-end case, representing a case where businesses are highly influenced by electricity prices and where the formation of an RTO proves to be a substantial factor in businesses locating or expanding in Western states.

Taking all these steps into account, Table 5-2 shows the top 15 key industries likely to grow in, or locate to, the West as a whole because of the advantages provided by RTO-induced electricity costs

[50] The literature reviewed to support this analysis included the general topics of energy economics, pollution haven hypothesis, and industrial organization. Specifically, the following sources were relied upon:

- Conrad K (2005) Locational competition under environmental regulation when input prices and productivity differ. Ann Reg Sci 39(2):273–295
- ICF (2012) An international comparison of energy and climate change policies impacting energy intensive industries in selected countries. Report for the Department for Business Innovation and Skills. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/31768/12-527-international-policies-impacting-energy-intensive-industries.pdf
- Jeppesen T, List JA, Folmer H (2002) Environmental regulations and new plant location decisions: evidence from a meta-analysis. J Reg Sci 42(1):19–49
- Levinson A (1996) Environmental regulations and manufacturers' location choices: evidence from the census of manufacturers. J Public Econ 62(1–2):5–29
- Panhans, Matthew, Lucia Lavrie, Nick Hanley (2016) The Effects of Electricity Cost on Firm Re-location Decisions: Insights for the Pollution Havens Hypothesis. Environ Resource Econ 68:893-914

savings. Other firms likely to be directly affected by the RTO's existence in the West are included in the "All Other Directly Affected Industries" row of the table.

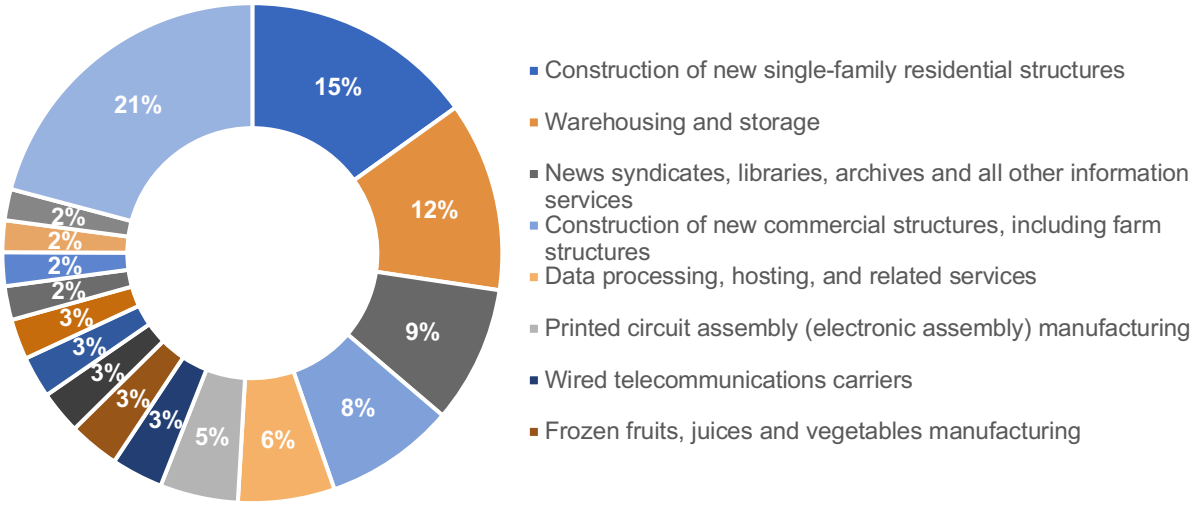
Together, these industries represent energy dependent firms that are expected to realize a competitive advantage by locating, or growing, in one or more Western states should electricity prices be lower with an RTO than they otherwise would. The third and fourth columns in Table 5-2 show the expected, direct increase in employment in the relevant sector in 2030 under the low-end and high-end assumptions, respectively. The final two columns help provide a reference to the relative size and compensation in the affected industries by reporting the total current employment and the average compensation (including benefits). The industries resulting from the screening and Industrial SWOT/Shift Share analysis, though limited in number and scope, still represent nearly 3.5 million FTE jobs across the West today.

Table 5-2 Key Industries Expected to Grow or Locate in the West Due to Lower Electricity Prices from an RTO

	Industry	Low Direct Growth (2030)	High Direct Growth (2030)	Current Employment	Total Payroll and Benefits
1	Construction of new single-family residential structures	7,661	34,812	392,331	$71,291
2	Warehousing and storage	6,227	28,296	361,822	$55,534
3	News syndicates, libraries, archives and all other information services	4,500	20,446	192,765	$229,462
4	Construction of new commercial structures, including farm structures	4,280	19,448	208,031	$70,323
5	Data processing, hosting, and related services	3,172	14,413	117,499	$164,341
6	Printed circuit assembly (electronic assembly) manufacturing	2,562	11,641	163,594	$82,320
7	Wired telecommunications carriers	1,696	7,705	123,666	$97,388
8	Frozen fruits, juices and vegetables manufacturing	1,666	7,570	60,643	$74,281
9	Bottled and canned soft drinks & water	1,412	6,418	98,697	$80,691
10	Roasted nuts and peanut butter manufacturing	1,368	6,217	61,698	$81,167
11	Frozen cakes and other pastries manufacturing	1,324	6,017	73,113	$46,064
12	Electronic computer manufacturing	1,110	5,043	91,761	$402,252
13	Construction of new power and communication structures	1,106	5,026	120,633	$73,597
14	Medicinal and botanical manufacturing	1,040	4,726	73,291	$144,737
15	Wood kitchen cabinet and countertop manufacturing	1,025	4,656	44,211	$55,372
	All Other	10,589	48,113	1,276,450	$109,343
	Total in Directly Effected Industries	**50,738**	**230,545**	**3,460,205**	**$107,221**

For ease of comparison, Figure 5-3 shows how the jobs estimates presented in Table 5-2 break down by industry segment.

Figure 5-3 Composition of Direct Job Growth in the West, by Industry, from Additional Business Activity



The analysis shows that the growth from lower electricity prices may be substantial, ranging from about 51,000 to 230,000 jobs, and would affect industries crucial to the West's long-term economic prospects. Notably, things like data center expansion or new data center location in the West which one would expect to be affected by lower electricity costs afforded by a Western RTO, shows up as a substantially affected industry.[51] Manufacturing and construction also show up as industries likely to be impacted, on aggregate, across the West. This would include modular homes, which is energy intensive and becoming a larger component of home construction. Beyond these directly affected industries, the expansion of business activity in the state will have other economic effects, which are reported (in conjunction with other impacts discussed in Section 5.3, below) in Section 5.4.

5.3 Incremental Clean Electricity Resource Investment

In addition to the impacts discussed above, an RTO also brings structural changes to the electricity markets which may result in additional electricity generating capacity being developed in the Western states than would otherwise occur absent an RTO. Specifically, an RTO provides a highly liquid market in which to sell electricity, allowing electricity generation resources that wish to sell their output directly

[51] Data center development/expansion is primarily captured in row five of Table 5-2 (Data processing, hosting, and related services). But, depending on how industries that require data storage choose to provision or self-provide those services, it may also show up in other industry categories as well.

through the RTO/wholesale market to do so and be compensated at the "Locational Marginal Price (LMP)" at their specific location on the electrical grid. This liquid market opens new opportunities for electricity resource contracting and, subsequently, developing and bringing online additional generation resources. These contracting opportunities, most notably Virtual Power Purchase Agreements (VPPAs),[52] are either not available, or are less available and offer less certainty, outside of an RTO. For this reason, energy consumers, especially large energy consumers with sustainability or clean energy goals, have more methods to contract for additional clean energy resources in regions where an RTO is operating. As a result, regions where an RTO is operating may see higher investment in clean electricity generation than would otherwise occur.[53]

This section describes the method used to estimate a low-end and high-end case for incremental clean energy development that might take place in the West due to the new contracting structures enabled by an RTO.[54] As with quantifying the potential range of new or expanded business activity that may occur in the West with the lower electricity prices provided by an RTO, there is uncertainty with respect to this quantification. On one hand, many states in the West are already on a path to significant clean energy penetration (with six targeting 100% clean electricity in the coming decades[55]), indicating there is likely to be significant clean energy development across the West regardless of the region's wholesale electricity market status. On the other hand, corporate buyers tend to drive further renewable energy investments in areas with RTOs[56] and previous studies have found that in order to achieve these state clean energy goals, more organized wholesale electricity markets (which provide needed system flexibility) may be required.[57]

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[52] VPPAs are known by a variety of other names as well, see for instance, the description and additional terminology provided by the Clean Energy Buyers Association (CEBA), here: https://cebuyers.org/programs/education-engagement/renewable-energy-procurement/

[53] The *State-Led Market Study*, which provided critical inputs into this study, assumed the electrical generation mix was held constant across different market configurations that were evaluated to help isolate the benefits of market operations. By default, with the exception of the incremental clean energy resource development discussed in this section, this study also assumed the generation mix was held constant between the status quo case and a case where a West-wide RTO is in operation. The additional clean electricity resources quantified in this section are assumed to be driven by higher demand from corporate buyers of clean energy.

[54] This quantification of incremental clean energy resources focused on new opportunities for VPPAs and did not quantify any pure "merchant" generation development that might occur.

[55] The six states targeting 100% clean electricity are: California's SB 100, Colorado's SB 19-236, Nevada's SB 358, New Mexico's SB 489, Oregon's HB 2021, and Washingtons SB 5116. These laws generally seek 100% clean electricity for the entire state or qualifying utilities by 2040, 2045 or 2050.

[56] As discussed more, later in this section, CEBA reports that (in 2020) 82% of corporate clean energy "deals" occurred in regions with RTOs/ISOs, while only about 66% of load is contained in these areas.

[57] See, for instance, *Western Flexibility Assessment*, prepared by Energy Strategies for the Western Interstate Energy Board (WIEB), page 8 which states: "*In the long-term, results indicate that it will be very difficult, or at least extremely costly, to achieve Western policy targets without broad coordination of wholesale markets.*"

In order to estimate incremental clean electricity resource build out in the West, the first step was to estimate total future "clean energy deals" that are likely to happen with corporate buyers across the entire country for low-end and high-end cases. Next, a methodology was developed to estimate the amount of *incremental* clean energy deals (based on the total deals in the U.S.) that might locate to the West, should the region be within the footprint of an RTO, under both a low- and high-end estimate. After the total estimated incremental build out in the West was calculated, the types and locations of that incremental investment were assumed and the associated direct construction and ongoing investment amounts were identified, such that the multiplier effects could be analyzed within IMPLAN.

QUANTIFYING FUTURE CLEAN ELECTRICITY DEALS ACROSS THE UNITED STATES

To quantify the potential "clean electricity deals" that are expected to occur in the United States between 2025 and 2035, the study relied primarily on historical data on the quantity of these deals reported by the Clean Energy Buyers Alliance (CEBA).[58] The amount of clean energy capacity attributed to large corporate buyers has increased substantially over the last few years, rising from 3.22 GW in 2015 to over 11 GW in 2021. For the low-end estimate of total corporate clean energy development in the country, this study assumed that these types of deals would, on the low-end, fall to about 50% of their 2020 levels (such that, for each year between 2025 and 2035, there would be roughly 5,250 MW of clean energy deals per year across the United States). For the high-end, the analysis assumed that the level of deals seen in the U.S. in 2020 would continue at roughly the same level through the 2025-2035 time period (or about 10,500 MW per year across the United States).

METHODOLOGY FOR QUANTIFYING INCREMENTAL CLEAN ELECTRICITY INVESTMENT IN THE WEST UNDER AN RTO

Next, a set of assumptions were developed to estimate the amount of incremental clean electricity resource deals for corporate buyers that might locate in the West due to RTO formation. The assumptions and approach varied for the low-end and high-end cases.

For the low-end estimate, another piece of information from CEBA was utilized, specifically that 82% of deals in its 2020 "clean energy tracker" were in organized wholesale markets (i.e. ISOs or RTOs).[59] In contrast, only about two-thirds of load is served by these markets.[60] Based on these figures, there

[58] The "CEBA Deal Tracker" can be found here: https://cebuyers.org/deal-tracker/ and it identifies the capacity of corporate PPAs, green power purchases, green tariffs and outright project ownership in the US.
[59] CEBA Deal Tracker, 2020.
[60] *Electric Power Markets: National Overview,* FERC, available: https://www.ferc.gov/electric-power-markets

are 25% more corporate deals for clean energy in organized wholesale markets than their straight load-ratio, suggesting that organized wholesale markets facilitate clean energy development used to meet corporate sustainability goals. The 25% increase above load-ratio share was used to estimate the incremental clean electricity resource development in the West under an RTO for the low-end case.

If the portion of the West that is not already in an RTO saw an increase of 25% more renewable energy deals for corporates than it would based on load ratio share, and the total national level of corporate clean electricity deals falls to 50% of its 2021 levels, the West would see between an additional 163-179 MW per year of clean energy resources developed across the footprint for each year between 2025-2035. In total, across the West, the low-end estimate assumes an additional 1,888 MW of clean electricity capacity would be constructed between 2025-2035 due to the new contacting mechanisms available to large energy users under an RTO. For modeling purposes, the analysis assumes that this incremental capacity is added in three distinct years (2025, 2030, and 2035), as shown in Table 5-3.

The high-end estimate of incremental clean electricity deals in the West that might take place due to RTO operation first relied on the high-end estimate of total clean energy deals for corporates across the country between 2025-2035 (around 10 GW per year). To determine the amount of incremental capacity that might located in the West, a different approach was taken than the low-end case. The high-end methodology intended to arrive at a larger (though still realistic) estimated quantity of incremental clean energy development in the West. In order to accomplish this and to align with the West's significant renewable resource potential, the high-end case focused on Western land area and renewable resource quality.

The 10 (non-California) Western states analyzed in this report represent about 29% of the U.S. land area[61] and about 13% of the country's electricity load.[62] The West has high quality renewable resources which, with the underlying contractual structures enabled by an RTO, may be particularly attractive to corporate buyers' seeking clean electricity resources. However, the West is not as populous as other regions and does not have the same level of total load requirements as is seen in the East. If the West saw corporate energy buyers demand increase to *more closely* align with its land-ratio share and renewable resource quality (due to the formation of an RTO), total clean electricity resources built in the region would increase. The high-end case assumes that the West would see clean energy development align at 75% of its land-ratio share, which would bring total corporate deals in the West to about 22% of **total** deals in the US. The incremental capacity developed in the West under the high-end case would range between 800 and 915 MW per year across the region, for a cumulative total of

[61] https://www.census.gov/prod/cen2010/cph-2-1.pdf; Table 18.

[62] Western Interconnection load, and associated load calculations, based on WECC's 2030 Anchor Data Set assumptions.

9,409 MW of incremental development between 2025 and 2035.[63] As with the low-end case, these investments have been placed into the study years of 2025, 2030 and 2035 for purposes of studying their economic impacts, as shown in Table 5-3.

Table 5-3 Additional Clean Electricity Construction Assumed in the West with an RTO

Additional Western Clean Electricity "Deal" Demand with an RTO	Low-End Estimate (MW)	High-End Estimate (MW)
2025	164	916
2026-2030* *(modeled as occurring in 2030)	844	4,399
2031-2035* *(modeled as occurring in 2035)	880	4,095
Total 2025-2035	**1,888**	**9,409**

TYPES AND LOCATIONS OF INCREMENTAL CLEAN ELECTRICITY INVESTMENTS

After determining the total additional assumed build out of clean electricity resources in the West that may occur due to RTO formation, assumptions were developed on location and type of clean energy resource that might be constructed. While the types and locations of these resources are intended to be representative of what might occur, actual resource type and location will depend on a variety of factors, including the types of corporations that choose to enter into contracts with new resources, the location of the corporate facilities, and their specific clean energy procurement practices and preferences, among other things.

The analysis assumed that incremental clean electricity resource development in the West would likely be one of two types: 1) wind or 2) solar with a co-located battery energy storage system (BESS). The

[63] While this is a substantial amount of development, it is viewed as a reasonable possible increase in clean energy development in the West given the scale of renewable development expected in the West in the coming years. For reference, the *Western Flexibility Assessment,* found the West must add roughly 9 GW per year between 2026 and 2035 to meet clean energy goals that existed at the time.

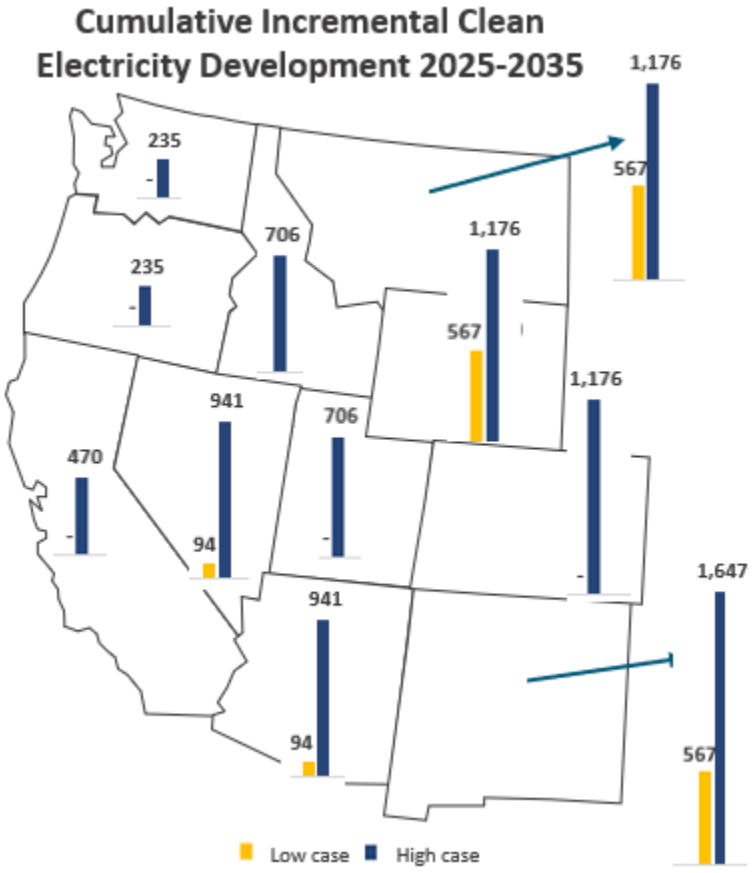
West is home to some of the best wind resources in the country, though many wind resources are currently far from load and their development may be hampered by the additive transmission costs to bring them to a large load. However, the transmission cost structures would be modified under an RTO, making remote resources, such as wind, more attractive and more likely to be developed under an RTO framework. The West is also home to high-quality solar resources, primarily across the southwest. Given recent development trends, where most solar resources are being developed to include some co-located BESS capacity, this report assumed that any solar resources developed and contracted to corporate offtakers would include a BESS component.[64] Under a low-end development case, on a percentage basis, more wind was assumed to be constructed (with 90% of the total incremental clean energy capacity assumed to come from wind resources in the low-end case). Because the incremental resource development is fairly minimal, with 1,888 MW across the entirety of the West over the 2025-2035 horizon, for this case, the locations of incremental resources were assumed to be more clustered in the states with some of the highest quality wind resources. Under the high-end case, the percentage of wind and solar/BESS was assumed to be evenly split, as illustrated in Table 5-4. With the larger total capacity in the high-end case, the geography of the incremental build-out was assumed to be spread across more of the Western states. The total assumed incremental clean energy build out, by state, is illustrated below in Figure 5-4.

Table 5-4 Technology Assumptions for Additional Clean Electricity in the West with an RTO

Resource Type	Low-End Assumptions		High-End Assumptions	
	%	MW (total 2025-2035)	%	MW (total 2025-2035)
Wind	90%	1,700	50%	4,705
Solar+BESS	10%	188	50%	4,705

[64] The addition of BESS is likely to be critical to corporate offtake structures where the ability to "shift" some portion of the solar output to non-solar hours using BESS will be important in economic competitiveness of the resource.

Figure 5-4 State-Level Development Assumptions for Additional Clean Electricity in the West with an RTO



CAPITAL AND OPERATING COST ASSUMPTIONS

After the capacity, type, and location of the incremental clean energy capacity was determined, the capacity build-out was translated into investment amounts for the construction period and for ongoing operations and maintenance associated with the projects. Both the capital costs and anticipated operations and maintenance costs were sourced from the National Renewable Energy Laboratory (NREL) 2021 Annual Technology Baseline (ATB)[65] and converted to 2022 dollars for use in this analysis. The "moderate" NREL-ATB price case was used and costs were not differentiated between Western states, with all Western states assumed to have the same capital and operations/maintenance expenses. Table 5-5 below, illustrates the assumed costs for wind and solar+BESS resource development.

[65] *2021 Annual Technology Baseline*, prepared by the National Renewable Energy Laboratory, available here: https://atb.nrel.gov/.

Table 5-5 Capital Cost and Operating Assumptions for Clean Electricity Projects

		2025	2030	2035
Capital Cost Assumptions (2022$/kW)	Wind	$1,277	$1,036	$985
	Solar+BESS	$1,633	$1,128	$1,071
Operations & Maintenance Cost Assumptions (2022$/kW-year)	Wind	$44	$42	$41
	Solar+BESS	$32	$25	$24

INPUT-OUTPUT MODELING OF CLEAN ELECTRICITY RESOURCES

These investment amounts, by state, were analyzed in IMPLAN to assess the direct and multiplier effects of these incremental investments from both the construction and ongoing operations and maintenance for these facilities.

The most important determinant in assessing the economic contributions for these types of energy projects is the portion of the capital cost expenditures that are assumed to occur within each respective state. Most of the plant and equipment necessary to construct wind and solar+BESS are manufactured outside the Western region. The majority of the local (state) expenditures for construction of renewable energy development projects are typically spent on site development, road access, facility construction, and related activities. In order to inform the assumptions for this analysis, estimated expenditure detail from the Jobs and Economic Development Impact Models (JEDI)[66] for wind and solar was evaluated, supplemented by prior project-specific economic analysis experience.

Based on those sources, it was estimated that approximately 20% of the capital cost expenditures for solar+BESS development, and 30% for wind development, would occur within each state and only those expenditures were included in the calculation of the contributions in the input-output modeling framework. It was assumed that the direct construction employment (workers) was obtained within each state, given the size of these labor markets. The direct impacts from these projects were evaluated in each individual state IMPLAN model to understand the multiplier effects associated with these potential future investments. The impacts from these investments will include one-time impacts from the construction, which are reported as construction/temporary impacts, and ongoing/permanent impacts from continued operations and maintenance for these facilities.

[66] *Jobs and Economic Development Impact (JEDI) Models,* prepared by NREL, available here: https://www.nrel.gov/analysis/jedi/.

5.4 West-Wide Combined Results from New/Expanded Business Activity and Incremental Clean Electricity Investments

This section reports the range of total economic impacts, on the low-end and high-end, expected from the combination of additional/expanded business activity (Section 5.2) and incremental clean electricity resource development which may occur with the existence of a Western RTO (Section 5.3).

The low-end reflects firms being relatively insensitive to energy price changes and seeing relatively small changes in industry growth patterns. It also represents the economic impacts of the low-end estimate for incremental clean electricity investments across the region.

Table 5-6 shows the total lower-bound gains in economic activity expected under an assumption of limited price sensitivity and relatively little additional clean electricity resource investment in the West. Gains in Gross Regional Product, income/compensation, taxes, and employment are all reported relative to what they would have been in the associated year had it not been for the formation of an RTO (in other words, results are incremental to the status quo). These figures reflect the direct growth, as well as the increased employment in firms associated with the supply and value chains of those firms directly affected. The impacts from increased investment in clean energy production include one-time installation and ongoing/permanent operations and maintenance. These impacts are included with those from new and expanded business activity and the combined economic impacts are reported in Table 5-6.

The analysis shows that, even on the low-end of anticipated impacts, the changes brought about by an RTO, in terms of additional clean electricity resource investments in the region and in new or expanded business activity, is expected to increase permanent jobs across the region by 140,700 in the 2030 timeframe. These jobs, on average, have a total annual compensation (payroll and benefits) of almost $10.5 billion (2022$) which helps contribute to a $17 billion increase in Gross Regional Product, and over $512 million in permanent, indirect taxes per year.

Table 5-6 Low-End Economic Impact from New/Expanded Business Activity and Clean Electricity Investments

West-Wide Low-End New Business Economic Impacts	Type	2025	2030	2035
Gross Regional Product (Million 2022$)	Permanent	$14,177	$17,027	$16,388
	Construction/Temporary	$65	$266	$264
Total Compensation (Million 2022$)	Permanent	$8,725	$10,456	$10,049
	Construction/Temporary	$39	$161	$160
Total Jobs (FTE)	Permanent	117,622	140,700	134,779
	Construction/Temporary	675	2,774	2,752
Total Indirect Taxes (Million 2022$)	Permanent	$421	$512	$498
	Construction/Temporary	$4	$16	$15

The high-end case reflects the upper-bound of potential growth resulting from firms under the assumption that those firms directly affected by the lower electricity prices afforded from an RTO have substantive price sensitivity. Thus, incremental changes in electricity prices would have more dramatic implications for growth, development, and/or relocation of businesses to the West. The high-end case also represents the economic impacts of the high-end estimate of incremental clean electricity resource investments in the region as a result of RTO formation, with 9,409 MW of additional development taking place between 2025 and 2035 due to the increased ability for large energy consumers to contract for output from clean electricity resources in an RTO.

The gains in Gross Regional Product, income, employment, and indirect business taxes from these high-end assumptions for business expansion and clean energy investments are presented in Table 5-7. These results reflect the economic activity for a given year, over and above what it would have been in the absence of the RTO. On the high-end of anticipated impacts, the changes brought about by an RTO, are expected to increase permanent jobs in the region by about 640,000 in 2030, which is an increase of 1.8% over jobs in the region in 2021. These jobs, on average, have a total annual compensation (payroll and benefits) of more than $47 billion per year (2022$) which helps contribute to a $77 billion increase in Gross Regional Product in 2030, and a $2.3 billion increase in permanent, indirect taxes per year, as illustrated in Table 5-7.

Table 5-7 High-End Economic Impact from New/Expanded Business Activity and Clean Electricity Investments

West-Wide High-End New Business Economic Impacts	Type	2025	2030	2035
Gross Regional Product (Million 2022$)	Permanent	$64,425	$77,377	$74,462
	Construction/Temporary	$373	$1,335	$1,181
Total Compensation (Million 2022$)	Permanent	$39,646	$47,518	$45,667
	Construction/Temporary	$228	$821	$726
Total Jobs (FTEs)	Permanent	534,479	639,335	612,370
	Construction/Temporary	3,785	13,669	12,090
Total Indirect Taxes (Million 2022$)	Permanent	$1,915	$2,323	$2,258
	Construction/Temporary	$14	$50	$45

6.0 TOTAL ECONOMIC IMPACTS FOR THE WEST

This section combines the results from Section 4 and Section 5 into a total range of expected economic impacts to the Western region associated with all of the potential impacts described in the prior sections,[67] including the effects of lower electricity prices on household disposable income and the impacts of additional or expanded business activity, including incremental clean energy investments, in the region. Thus, this section reports the "grand total" range of expected economic impacts to the region as a result of RTO operation in the Western Interconnection.

Table 6-1, below, presents the combined economic impact results from Section 4 and the low-end case outlined in Section 5. Even in a low-end case, the economic impact to the 11-state region is expected to be significant, increasing 2030 total regional income by 0.34% over its current level, through the addition of nearly 159,000 new, permanent jobs in total. Additional, permanent tax revenues of $619 million per year are also anticipated in 2030, along with an increase of $18.8 billion in Gross Regional Product across the footprint.

Table 6-1 Low-End Total Economic Impact Results Attributed to RTO Formation

West Wide Low-End TOTAL Economic Impacts	Type	2025	2030	2035
Gross Regional Product (Millions 2022$)	Permanent	$15,629	$18,818	$18,158
	Construction/Temporary	$65	$266	$264
Total Compensation (Millions 2022$)	Permanent	$9,575	$11,504	$11,084
	Construction/Temporary	$39	$161	$160
Total Jobs (FTEs)	Permanent	132,030	158,506	152,364
	Construction/Temporary	675	2,774	2,752
Total Indirect Taxes (Millions 2022$)	Permanent	$508	$619	$605
	Construction/Temporary	$4	$16	$15

As illustrated in Table 6-2, on the high-end, the economic impacts are expected to be quite substantial, increasing total income across the region by 1.45% over its current level through the addition of more

[67] With the exception of the direct RTO investments discussed in Appendix A, which are not included in these totals.

than 657,000 new, permanent jobs in total in the 2030 timeframe. Under the high-end case, the permanent increase to Gross Regional Product in 2030 is expected to be over $79 billion and additional, permanent tax revenues of $2.4 billion per year in 2030 are also anticipated in 2030.

Table 6-2 High-End Total Economic Impact Results Attributed to RTO Formation

West-Wide High-End TOTAL Economic Impacts	Type	2025	2030	2035
Gross Regional Product (Millions 2022$)	Permanent	$65,877	$79,167	$76,232
	Construction/Temporary	$373	$1,335	$1,181
Total Compensation (Millions 2022$)	Permanent	$40,496	$48,566	$46,702
	Construction/Temporary	$228	$821	$726
Total Jobs (FTEs)	Permanent	548,887	657,141	629,955
	Construction/Temporary	3,785	13,669	12,090
Total Indirect Taxes (Millions 2022$)	Permanent	$2,002	$2,430	$2,365
	Construction/Temporary	$14	$50	$45

The charts below illustrate the range of economic impacts that might be expected to accrue to the Western region based on the low-end and high-end cases assessed in this study.

Figure 6-1 illustrates, by representative year, the expected increases in ***ongoing*** Gross Regional Product, total compensation (payroll and benefits) and indirect business taxes that could be added across the region due to the changes brought about by the existence of an RTO. Figure 6-2, illustrates the ***construction/temporary*** jobs, based on the year in which the construction is expected to take place. While the construction jobs are still meaningful and could be higher in actuality (especially to the extent additional transmission facilities are required to be built to support incremental clean electricity resource investments), the magnitude of permanent increases to Gross Regional Product, total compensation, and indirect business taxes is roughly 50 times larger than the construction/temporary impacts, indicating that the existence of an RTO can provide meaningful, ongoing economic benefits to the region.

Figure 6-1 Permanent Economic Impacts to the West from an RTO

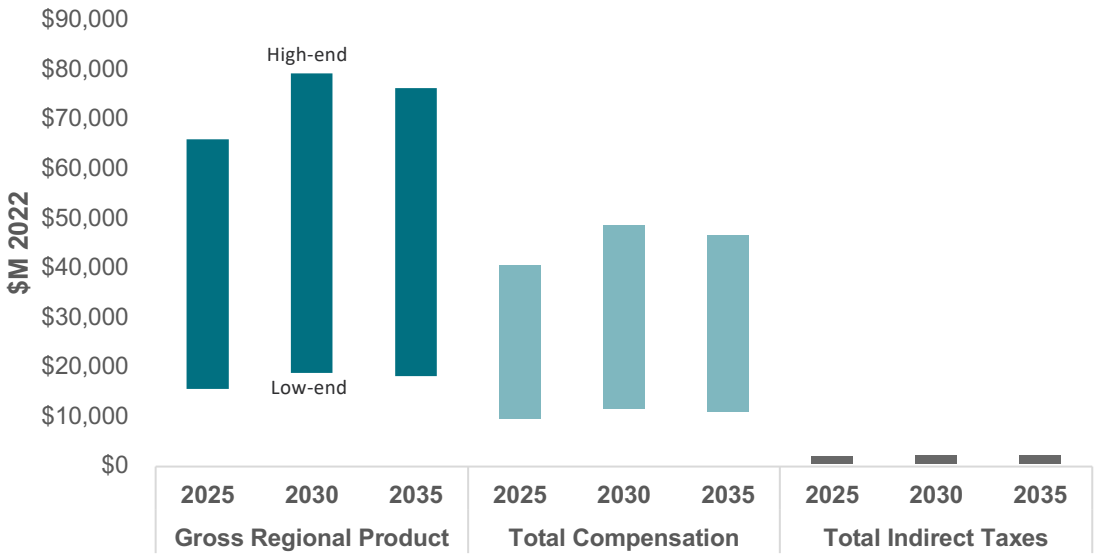


Figure 6-2 Construction/Temporary Economic Impacts to the West from an RTO

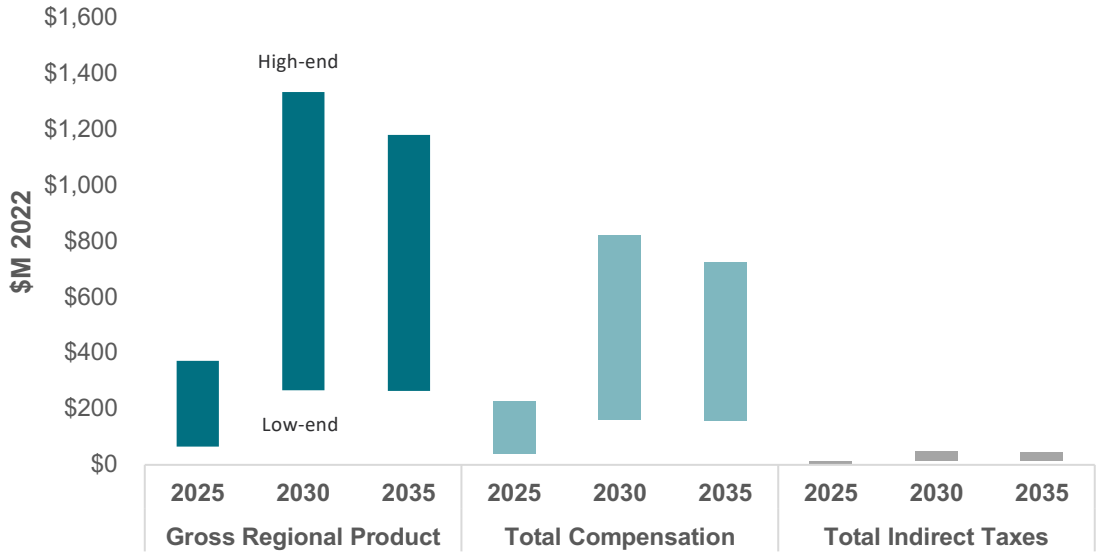
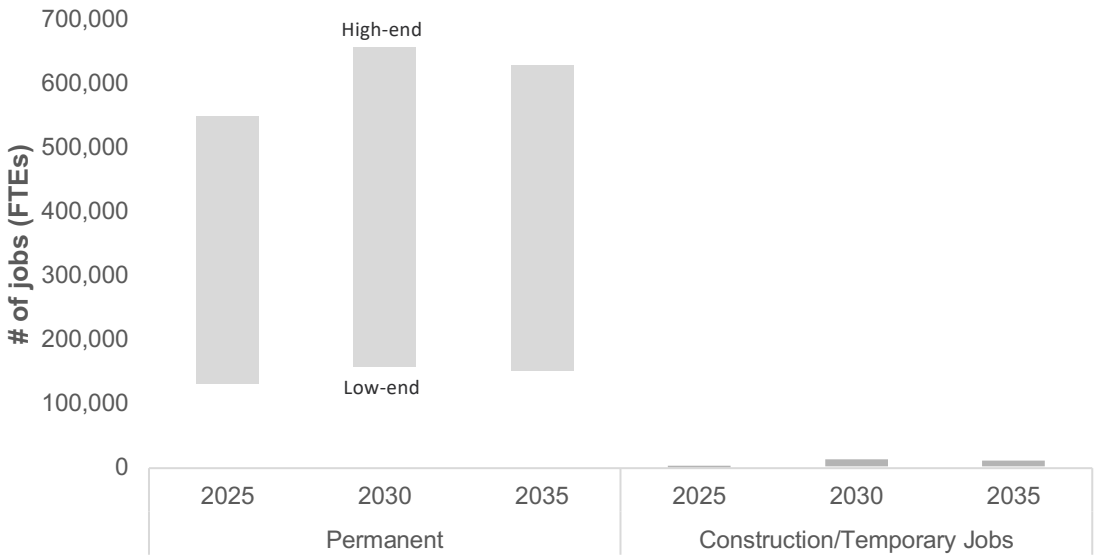


Figure 6-3 illustrates that the vast majority of the jobs that would be expected to be created in the economy from an RTO would be permanent, ongoing jobs. In 2030, the existence of an RTO, would be expected to result in an additional 159,000 jobs (low range) and 657,000 (high range) ongoing jobs for the region, while the construction/temporary jobs are much more modest.

Figure 6-3 Permanent and Temporary Jobs (FTEs) Created by an RTO in the West



7.0 CONCLUSION AND KEY FINDINGS

As discussed throughout this report, and illustrated in Figure 1-1, the West could expect significant economic benefits from a West-wide RTO in the 2030 timeframe. Benefits to the economy would be driven by:

- Electricity cost savings providing higher levels of disposable income for households than they would have in a continuation of the current electricity market structures;
- The potential for additional clean electricity resource development in the region to meet corporate demand; and
- Expansion of existing or attraction of new businesses to the Western states.

The sooner RTO development occurs, the sooner states in the West can begin to realize these benefits. While this study present results for 2025, 2030 and 2035, these are representative years and actual RTO benefits will likely take some time to fully materialize after an RTO is stood up. Key highlights of the expected range of economic benefits for the West from the formation of a West-wide RTO are outlined below.

JOBS & LABOR INCOME

- This analysis finds that a West-wide RTO could provide **between 159,000 and 657,000 new, permanent jobs across the West in the 2030 timeframe**.
  - This translates to between $11.5 billion and $48.6 billion per year in additional total compensation which represents between about 0.3% and 1.5% of current total income across the 11-state region.
  - As a result of the direct and multiplier effects of RTO formation, the **average job created across the region would have total payroll and benefits of roughly $73,000 per year**.
- Additionally, in the 2030 timeframe, a West-wide RTO could **provide between 2,800 and 13,700 temporary (construction) job-years**, associated with the construction of additional renewable energy projects (modeled as wind and solar+storage).

TAXES

- As the result of the impacts of RTO formation, permanent, incremental tax contributions (via indirect business taxes) to the 11 states in the region are expected to range from $619 million to $2.4 billion per year in the 2030 timeframe.
  - Total tax impacts are likely to be higher, but the scope and broad geography of this analysis, necessitated a simplified assessment of tax impacts which do not assess income taxes, and special allowances for energy projects, etc.

  - The **temporary (construction) indirect business tax contributions in the 2030 timeframe range from $16 million to $50 million per year** from the development of incremental clean energy in the region in that timeframe.

GROSS REGIONAL PRODUCT (GRP)

- As a result of RTO formation and the associated impacts, **permanent Gross Regional Product contributions to the 11 states in the region are expected to range from $18.8 billion to over $79 billion per year in 2030**.

- The **temporary (construction) Gross Regional Product contributions in 2030 range from $266 million to $1.3 billion per year** due to the development of incremental clean electricity resources in the region that may occur due to RTO formation and operation.

DIRECT INVESTMENTS

- The formation and operation of a West-wide RTO will require additional investments in hardware/software, office space and staff. This direct investment could theoretically occur in any Western state. Wherever the investment occurs, it will have direct and multiplier effects, representing positive economic impacts for that state.

- Based on an analysis of several states where the direct investment might occur (described more in Appendix A), we anticipate the following additional benefits, which were not added to the tables and charts in this report, as they have not been assigned to one state in particular and, thus, are not included in the individual state reports:

  - **An additional $160-$200 million annually in increased permanent Gross State Product contributions from the RTO investment impacts (wherever that occurs).**
  - **1,600-2,000 new permanent jobs with total compensation between $99 million and $133 million.**
  - **New tax revenue of $6.3 million to $9.6 million annually**.

7.1 Study Findings and Observation

The study resulted in the following findings. These findings are driven heavily by the methods, assumptions, and purpose of the analysis.

- While electricity rates across the region are currently facing upward pressure, **an RTO is expected to reduce electricity prices compared to what they otherwise would have been**, as demonstrated by various studies, including the State-Led Market Study. **This will create an opportunity for additional economic benefits to flow to states participating in the RTO**.

- After considering likely RTO operational/administrative costs, **RTO-related electricity cost savings are expected to provide additional disposable income for households compared to the status quo**. This increased disposable income will have multiplier effects across the economy which will result in relatively small, but meaningful, economic benefits for the region, including:

  - Creation of nearly 18,000 new, ongoing jobs across the region.
  - Increased Gross Regional Product across the region of nearly $1.5 billion per year.
  - The addition of $108 million per year in indirect business taxes.

- **More competitive electricity prices in the West, that result from an RTO, may also drive certain businesses that are highly affected by electricity prices to locate within the West or expand their operations in the West. The structural changes to electricity markets that RTOs create may also attract new clean energy investments in the region, to help serve businesses with clean energy goals.** The range of potential impacts assessed in this study varies based on how price sensitive businesses may be to changes in electricity prices and on how many incremental clean energy resources are developed in the West. The range of potential economic impacts from new business creation/expansion is large, but demonstrates that impacts will likely be significant and positive across the region, including:

  - **Creation of between 140,000 and 639,000 new, ongoing jobs from new business expansion or location in the West.**
  - **Increased Gross Regional Product across the region totaling between $17 billion and $77 billion per year.**
  - **$512 million to $2.3 billion per year in incremental indirect business taxes.**
  - Incremental clean energy investments would have construction related impacts as well as ongoing operational impacts that are additive to the economic impacts described above.

- In several respects this analysis has taken a conservative approach, including only evaluating a subset of energy-related RTO benefits. **Nevertheless, the results of this analysis suggest that a West-wide RTO would likely have a strong, positive economic impact across the West, creating a wide variety of new jobs and increasing household disposable income relative to what it would be absent an RTO**.

7.2 Study Considerations and Caveats

As discussed throughout the report, this study has sought to address the uncertainty associated with the analysis by: 1) developing reasonable methods to come up with an estimate of anticipated benefits, or other inputs and assumptions; and 2) through the use of a range of potential economic impacts. However, that approach alone does not capture all of the potential outcomes and implications of RTO development in the region, many of which will depend on policy and market design choices that are not yet known. Additionally, this study, as with all studies, relies on a number of assumptions and makes certain simplifications in order to arrive at the results. Some of the key caveats and considerations that readers should keep in mind when reviewing and interpreting the results of this analysis are.

- **Data for individual years should be viewed as representative of the trend of RTO-related economic benefits over time and not necessarily as indicative of benefits in that particular year**. This report analyzes the expected economic benefits of an RTO in three representative years (2025, 2030, and 2035). These years were selected to help demonstrate the sustained nature of the economic impacts of an RTO and the relative direction that benefits are expected to move in the long-term. However, it is important to note that the study has **not** made an explicit assumption about the precise date a Western RTO might become operational in the region and how long it may take for these impacts to accrue (or ramp up) following RTO development. The quantification of electricity system RTO benefits within this study relies primarily on the study results from the State-Led Market Study. That study analyzed RTO-related benefits in 2020 – even though no RTO existed at the time – and in 2030, in part to help identify the likely trajectory of electricity system RTO benefits over time. Thus, it is important to keep in mind that the economic benefits reported herein, for each of the representative years, represents the economic benefits expected to accrue once an RTO is operational and mature enough to make an impact.

- **Electricity cost savings from an RTO that are reported in this analysis are measured against a "status quo" case without an RTO and should not be interpreted as implying electricity prices will fall below today's levels**. Electricity costs in the West (and across the country) are likely to face upwards pressure in coming years as aging infrastructure is replaced and new infrastructure is added to the system. In the West, the expansion of organized wholesale electricity markets, including RTOs, is

likely to result in electricity cost savings relative to the "status quo." But it is important for readers to understand that references to electricity cost savings, reduced electricity rates, electricity system benefits, or lower electricity prices within this report are **not** intended to imply that electricity prices will decline from today's levels. Rather those savings/benefits are measured compared to a status quo case and represent the savings relative to a situation in which new organized wholesale market expansion does not occur in the West and only already existing markets, such as the WEIM and WEIS, continue to operate.

- **The study offers a conservative estimate of impacts because it only assesses the economic impacts that flow from two types of electricity-related RTO benefits and does not capture a host of other electricity-related benefits brought by RTOs, which may be substantial**. Consistent with the use of the State-Led Market Study results, this study captures the anticipated economic benefits that will flow from just two energy-related categories of RTO benefits: 1) operational savings associated with dispatching and operating the generation fleet in the West more efficiently, and 2) capacity savings associated with avoiding the procurement or construction of capacity resources through pooling of load and resource requirements. There are a number of other RTO-related benefit categories which can be more difficult to quantify. Those additional benefit categories may have additional positive economic impacts, beyond those reported here. This includes the benefits of increased reliability that may be brought about by an RTO which could avoid load-shedding and bring significant positive economic impacts (or, more accurately, avoid negative economic consequences of outages).

- **In general, this study is focused on the income/expenditure and business impacts that flow from electricity cost savings associated with an RTO and not on broader changes to the generation portfolio that might shift generation build out across the region (though a limited set of generation portfolio impacts were analyzed)**. The existence of an RTO may change the economics of where future electricity generation resources are located within the Western Interconnection. With the exception of assessing potential incremental clean electricity resource development to meet corporate clean energy interests, this study generally did not assess the state-by-state economic impacts of potential changes to electricity generation locations that might be associated with an RTO. This is primarily due to the fact that this study relied on the analysis performed as part of the State-Led Market Study, which did **not** assess different generation and transmission portfolios between cases in order to help isolate the benefits of market formation/operations within that study. Had these potential impacts been assessed, we anticipate overall jobs and economic benefits would not have varied significantly across the region as a whole, though individual states may see shifts in jobs or sectors in which jobs are expected to be created. Additionally, had the full effects of different generation portfolios been studied, the electricity system benefits of an RTO

would likely have been greater than what was quantified in the State-Led Market Study. This, in turn, would have flowed through to higher economic impacts under this study methodology.

- **This study represents a likely range of economic impact outcomes from an RTO, though the authors hypothesize that, for the impacts where ranges are presented, the range is likely skewed toward the lower end.** This report includes a range of likely impacts associated with RTO operation in the West, quantifying low-end and high-end impacts. The range stems from assumptions around how sensitive businesses will be to electricity prices and on how much incremental clean electricity might be developed in the region. Based on the literature review and the nature of business sensitivities, it is the authors' assessment that the results do not follow a normal distribution and, instead, are likely to be weighted to the lower end of the distribution, which still offer substantial, positive impacts to the region.

- **RTO benefits have been netted with costs to operate and administer the RTO but are not full "net" benefits of an RTO and actual net benefits to individual utility customers may vary depending on a number of factors.** The RTO benefits relied for this economic impact assessment are net of estimated RTO operational costs but are not net of other potential cost impacts, such as utility-level technology investments or staffing costs that may be required to participate in an RTO. These benefits are also not "netted" by potential transmission cost shifts that may be brought about for individual utilities/states by an RTO. Both of these categories of costs will be important factors in the actual economic impacts across states and individual utilities. But these impacts will be highly dependent on the specifics of a utility's particular situation, along with RTO market design, and are not feasible to capture in an analysis of this scope.

- **While the study made efforts to capture overall changes in economic impacts, there are inherent uncertainties and a host of different shifts in jobs that may occur across the region.** The RTO benefits quantified in the State-Led Market Study includes both operational savings associated with dispatching and operating the generation fleet in the West more efficiently and capacity savings associated with avoiding the procurement or construction of capacity resources by capturing load diversity savings among utility participants. Capacity savings resulting from RTO formation could result in slowed investment in energy infrastructure or reduced jobs from the avoided generation build out within individual states and the region as a whole. This analysis does not explicitly capture those potential impacts. This study's approach is to treat the capacity savings associated with RTO development as an efficiency gain in the economy, since the investment capital will be shifted to other, more efficient uses in the economy. Additionally, decreases in the price of electricity may drive increased demand, which would (in turn) cause the need for construction of additional generation facilities, especially if customers elect to electrify their homes. The shift in energy

infrastructure investments was not captured in this analysis but would result in net positive impacts as those investments would be shifted to next best alternatives.

- **The study utilized a standard tax module within the IMPLAN model to determine potential indirect business taxes associated with the direct and multiplier effects activity studied herein. Thus, this assessment is not an in-depth tax analysis, nor did it include an in-depth analysis of potential tax breaks or tax specific impacts on a state-by-state basis.** The anticipated tax impacts reported herein should be thought of as proximate and not precise. More detailed tax impact assessments may be warranted on a project-specific basis but were not appropriate for a study of this nature which is, inherently, high-level and geographically broad. Tax codes across the West are not uniform across states or municipalities and would result in differential impacts. As such, this study does not replace the need for project specific economic impact assessments for future business development in the West.

These factors notwithstanding, we are confident in the reasonableness of the assumptions relied on for this study and consider the results to be an informative and indicative of the economic impacts that may accrue to the Western region should an RTO form and operate in the footprint in the coming years. We are hopeful this report provides policymakers and other stakeholders with useful information on anticipated economic impacts as utilities, states, commissions, market operators, and others consider the expansion of wholesale electricity markets across the West.

APPENDIX A: ADDITIONAL DIRECT INVESTMENT IMPACTS FROM RTO FORMATION

In addition to the impacts reported above, the formation or expansion of an RTO in the West will require additional direct investments in the form of hardware/software, office space, and staffing to support the RTO's operations. These are discussed in Section 3.1 as the administrative/operational costs of RTO operation. Only a portion of the total RTO costs will be *incremental* in the region and result in new spending/investment. The incremental investment in RTO administration/operations that would be needed to support a West-wide RTO could theoretically occur in any Western state. This study provides a range of potential, incremental economic impacts that may result to a given state, should that investment take place within that state.

The estimated incremental RTO operational costs (above and beyond what is spent on ISO/RTO operation in the region today) is expected to be roughly $116M in 2025, $137M in 2030 and $162M in 2035 (with the cost increasing along with the anticipated load growth in the region, since costs of RTO operation assumed in this study were calculated on a $/MWh basis). These direct investment costs were allocated to different components of RTO-related costs in a manner generally consistent with market operator budgets in the region, as illustrated in Table A-1.

Table A-1 Categories and Amounts of Incremental Direct RTO Investment Spending to Operate an RTO

RTO Administrative/Operational Cost Category	%
Capital Expense (bond payments for construction of new facilities)	6%
Software/Computer Hardware (Capital Expense)	12%
Salaries and Benefits	62%
Occupancy costs and equipment	1%
Telecom and hardware/ software maintenance	6%
Consultants	5%
Outsourced contracts/professional fees	5%
Travel, training, other	3%

These direct investments were modeled in a number of representative Western states. Modeling the impacts in several states helped to bound the likely range of economic effects on any individual

Western state should this incremental investment take place in that state. The resulting range of additional, positive economic impacts that may accrue to a Western state, should this level of RTO investment occur in its footprint, are illustrated in Table A-2, below, and are additive to the impacts discussed in the main body of the report. These impacts are ***not*** included in the overall economic impacts to the West, reported in Section 5 or in Section 6. These impacts have not been attributed to any state in particular and will not be reported in the individual state summaries due to the potential for misinterpretation as double-counting.

Thus, the range of economic impacts outlined below should be viewed as representative of the incremental economic impacts a state might expect if the direct, incremental investment to operate a West-wide RTO occurs in that state.

Table A-2 Representative State-Level Economic Impact Results from Incremental, Direct RTO Investment

Representative Range of State Impacts from Direct RTO Investment	2025	2030	2035
Incremental Amount of RTO Direct Investment (Millions 2022$)	$116	$137	$161
Gross State Product (Millions 2022$)	$135 – $169	$160 – $200	$188 – $236
Total Compensation (Millions 2022$)	$84 – $113	$99 – $133	$116 – $157
Total New Ongoing Jobs (FTEs)	1,400 – 1,700	1,600 – 2,000	1,900 – 2,300
Total Indirect Taxes (Millions 2022$)	$5.4 – $8.1	$6.3 – $9.6	$7.5 – $11.3

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